

168 U113
12
TM
1944

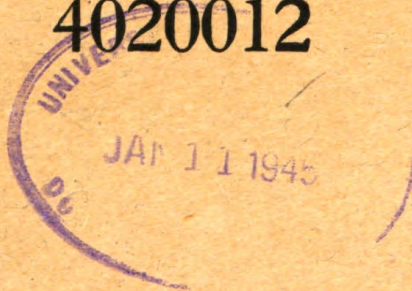
TM8-619

WAR DEPARTMENT TECHNICAL MANUAL

U.S. Dept. of Army

BASAL METABOLISM APPARATUS

ITEMS
4020006, 4020008,
4020012



WAR DEPARTMENT

OCTOBER 1944

BASAL METABOLISM APPARATUS

ITEMS
4020006, 4020008,
4020012



WAR DEPARTMENT

OCTOBER 1944

United States Government Printing Office, Washington: 1944
For sale by the Superintendent of Documents, Washington, D. C.

WAR DEPARTMENT,

WASHINGTON 25 D. C., 20 October 1944.

TM 8-619, Basal Metabolism Apparatus, Items 4020006, 4020008, 4020012, is published for the information and guidance of all concerned.

[A. G. 300.7 (15 Sep 44).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

J. A. ULIO,
Major General,
The Adjutant General.

DISTRIBUTION:

As prescribed in paragraph 9a, FM 21-6:

**Armies (2); Corps (2); Depts (10); Sv C (5); ID 8 (4); IB 8 (1);
IR 8 (3)(2)(1); IC 8 (2); Base C (5); Numbered Air Forces (5);
Med Deps (Continental) (25) except St Louis Med Dep (50);
T of Opn (10); PE (2);**

**ID 8: T/O & E 8-550;
IB 8: T/O & E 8-610, 8-611;
IR 8 (3): T/O & E 8-580, Evac Hosp; 8-581;
IR 8 (2): T/O & E 8-510, 8-560, 8-590;
IR 8 (1): T/O & E 8-580, Conval Hosp;
IC 8: T/O & E 8-187; 8-572S; 8-667.**

For explanation of symbols, see FM 21-6.

CONTENTS

U113
12
TME-619
1944
★ PAGE
1-2 1
3 1-2

CHAPTER 1. INTRODUCTION.

Section I. General	1-2	1
II. Description	3	1-2

CHAPTER 2. OPERATING INSTRUCTIONS, McKESSON.

Section I. General	4	3
II. Service upon receipt of equipment	5-6	3
III. Controls and instruments	7-8	3-5
IV. Operating under usual conditions	9-13	5-9

CHAPTER 3. OPERATING INSTRUCTIONS, SANBORN.

Section I. General	14	10
II. Service upon receipt of equipment	15-16	10-12
III. Controls and instruments	17-18	12-14
IV. Operating under usual conditions	19-25	14-19

CHAPTER 4. MAINTENANCE INSTRUCTIONS, McKESSON.

Section I. General	26	20
II. Lubrication	27	20
III. Preventive maintenance services	28-31	20-21
IV. Trouble shooting	32-41	21-23
V. Maintenance operations	42-56	23-26

CHAPTER 5. MAINTENANCE INSTRUCTIONS, SANBORN.

Section I. General	57	27
II. Lubrication	58	27
III. Preventive maintenance services	59-64	27-28
IV. Trouble shooting	65-72	28-29
V. Maintenance operations	73-92	29-44

APPENDIX I. SHIPMENT AND STORAGE.

Section I. McKesson	45
II. Sanborn	45

APPENDIX II. USE OF CAPILLARY PEN, SANBORN

47

APPENDIX III. LIST OF ALL SERVICE PARTS.

Section I. McKesson	48
II. Sanborn	50

INDEX

53

M558163

III

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. SCOPE. These instructions are published for the information and guidance of the personnel to whom this equipment is assigned. They contain information on the operation and first and second echelon maintenance of the equipment as well as illustrations identifying the various parts. They apply to—

4020006 Basal Metabolism apparatus, 110 volts, 25 cycles.

4020008 Basal Metabolism apparatus, 110 volts, 60 cycles.

4020012 Basal Metabolism apparatus, 220 volts, 60 cycles.

2. RECORDS. No records are required to be kept on this apparatus except as may be designated by the medical officer in charge.

Section II. DESCRIPTION

3. DESCRIPTION. a. General information. The basal metabolism apparatus considered in this manual is a standard apparatus utilizing the oxygen consumption method for determining the metabolic rate under basal conditions.

b. Source of electric power. The source of electric power must be the same as specified on the nameplate. However, the operation and maintenance of the machines operating on the various currents are identical and the discussion in this manual covers them all.

c. Charts. (1) The McKesson Recording Water Type Metabolizer uses the roll type chart-basal metabolism chart, McKesson, 100: Medical Department item No. 4021008.

(2) The Sanborn Waterless Metabolism Tester uses two types of charts.

(a) A waxed chart which is used with the stylus. It is basal metabolism chart, Sanborn, 8-MC, 100: Medical Department item No. 4021023.

(b) An unwaxed chart is used with the capillary pen. It is basal

metabolism chart, Sanborn, 9-MC, 100: Medical Department item No. 4021030.

- d. Manufacturers.** The manufacturers of these equipments are:
- (1) McKesson Appliance Co., Toledo, Ohio.
 - (2) The Sanborn Co., Cambridge, Mass.

CHAPTER 2

OPERATING INSTRUCTIONS, McKESSON

Section I. GENERAL

4. SCOPE. This chapter contains information for the guidance of the personnel responsible for the operation of the McKesson Recording Water Type Metabolor Model No. 176. It contains information on the operation of the equipment with the description and location of the controls and instruments.

Section II. SERVICE UPON RECEIPT OF EQUIPMENT

5. NEW EQUIPMENT. a. Unpacking. To unpack, proceed as follows:

- (1) Remove stand from its container.
- (2) Remove metabolor from its container by grasping the flexible breathing tube support and lift straight up and out.
- (3) Make sure all parts are removed before discarding the packing material.

b. Assembling. The apparatus will be received ready for operation with the exception of mounting the Y-piece inhaler. This is accomplished by merely slipping the ends of the Y-piece inhaler into the sleeves of the breathing tubes. See paragraph 10 for instructions on the addition of soda lime, water, and oxygen.

6. USED EQUIPMENT. a. Unpacking. The same procedure should be followed as for new equipment. (See par. 5.)

Section III. CONTROLS AND INSTRUMENTS

7. CONTROLS. a. Toggle switch. The toggle switch (fig. 1) at the base starts and stops the chart.

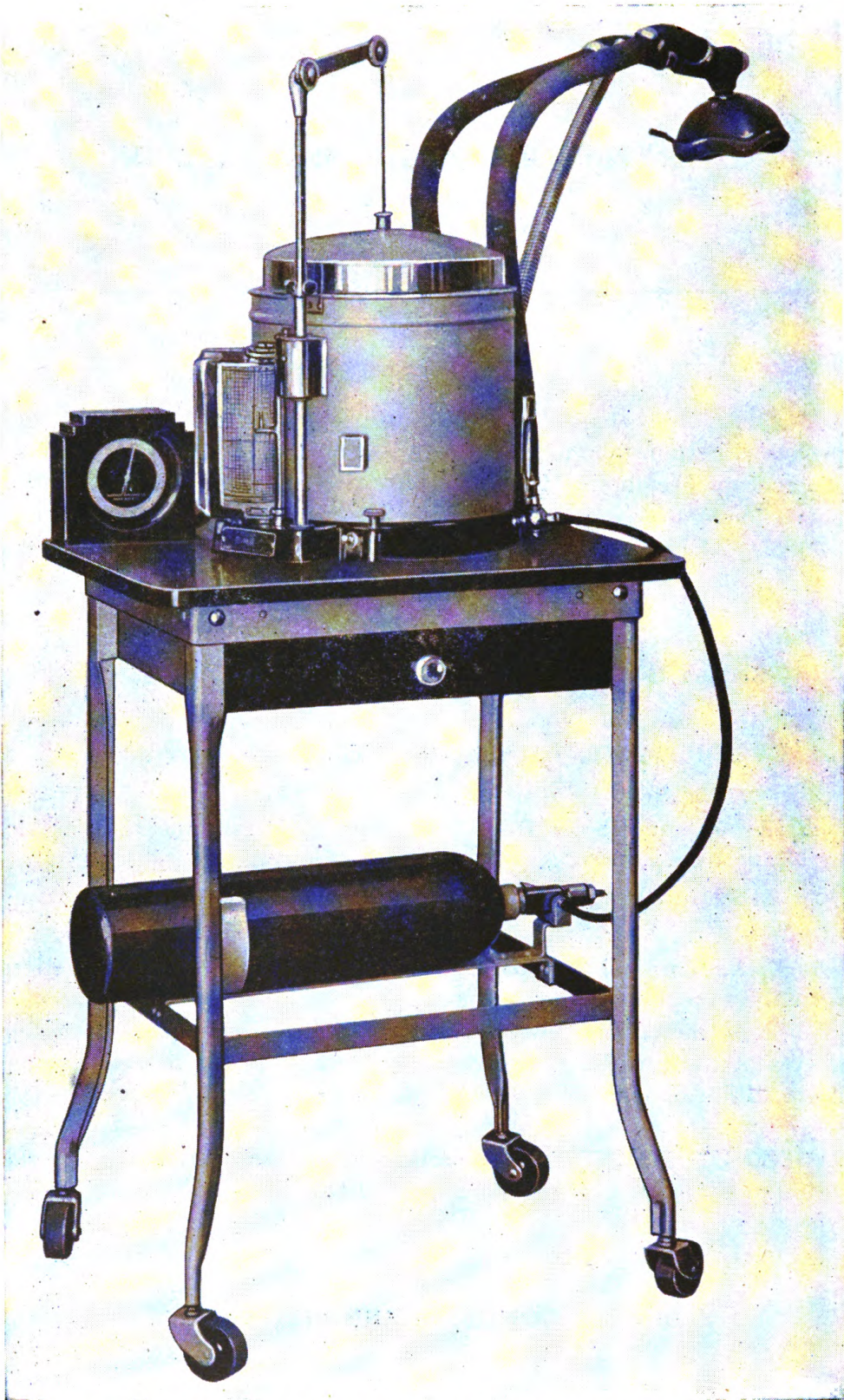


Figure 1. McKesson Recording Water Type Metabolator Model No. 176.

b. Oxygen stopcock. The stopcock (fig. 1) is at the base of the apparatus near the thermometer. It regulates the flow of oxygen into the bell.

c. Y-piece inhaler shut-off valve. The Y-piece inhaler shut-off valve (fig. 2), when in the closed position, closes off the ends of the inhaler tubes and allows the patient to breathe into the atmosphere. In the open position, the patient breathes directly into the bell.

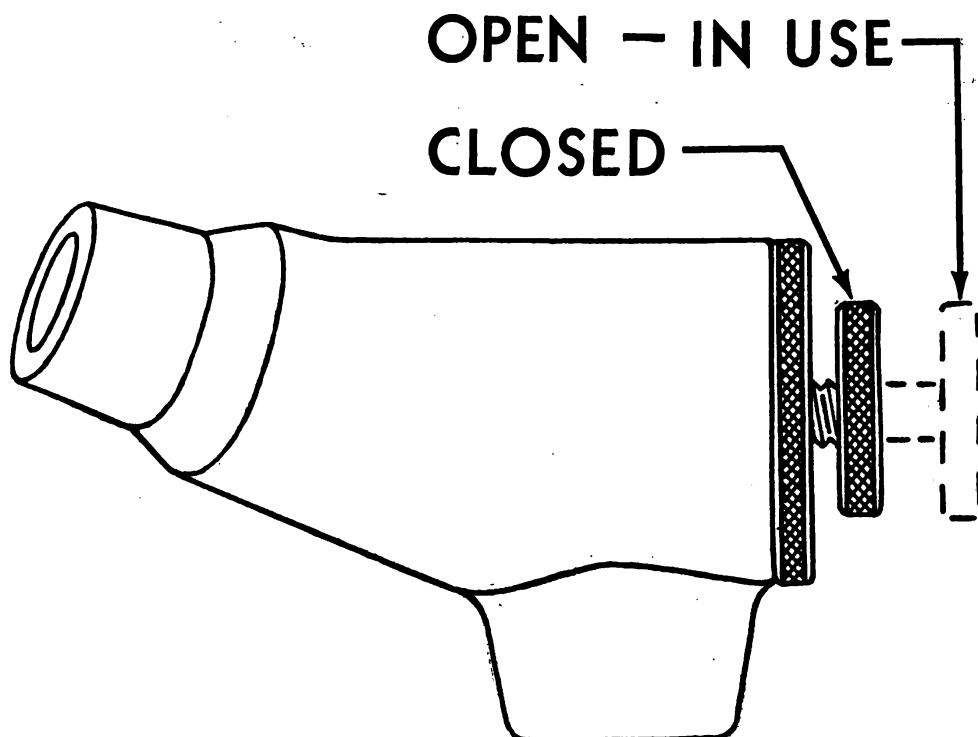


Figure 2. Y-piece inhaler.

d. Water stopcock. The stopcock at the base of the apparatus opposite the toggle switch is used to drain the water from the moat.

8. INSTRUMENTS. a. Thermometer. The thermometer (fig. 1), at the base, indicates the temperature for use in calculating the metabolic rate of the patient.

b. Barometer. The barometer (fig. 1), which is separate, indicates the barometric pressure for use in calculating the metabolic rate of the patient.

Section IV. OPERATING UNDER USUAL CONDITIONS

9. GENERAL. The McKesson Recording Water Type Metabolor measures the patient's basal metabolic rate by putting an unmeasured

amount of oxygen at the disposal of the patient, and the rate of oxygen consumption per hour is computed by the patient's chart and slope line. This method involves the use of a thermometer and barometer.

10. PREPARATION OF APPARATUS FOR OPERATION. **a. Level apparatus.** Two leveling screws on the base are provided to level the apparatus. Adjust until the bell can be raised and lowered without touching the sides of the moat.

b. Charge with soda lime. (1) Unhook the counterweight cord from the bell.

(2) Loosen the thumbscrew at the base of the upper crane, then swing the crane to the left.

(3) Lift out the bell.

(4) Lift out the soda lime container by a twisting rocking movement.

(5) Pour 1 quart of soda lime granules into the container and sprinkle with a few drops of water, but not enough to saturate.

(6) Before replacing the soda lime container, examine the rubber flutter valve in the bottom of the apparatus to see that it stands perpendicular.

(7) Replace the soda lime container with a rotating motion. Be careful that the flutter valve does not become doubled over as under these conditions exhalations cannot be blown through it.

c. Test flutter valve. (1) Without attaching the Y-piece inhaler to the breathing tubes, test the flutter valves. If the flutter valve is operating properly, it is possible to blow easily into one of the breathing tubes, but not to inhale from it; the other may be inhaled from, but not exhaled into.

(2) Attach Y-piece inhaler.

(3) Replace soda lime container.

d. Fill moat with water. (1) Replace soda lime container.

(2) Replace the bell and pour water (having the same temperature as the room) into the moat around the bell until it reaches the bead which is about 1 inch from the top (fig. 3). Excess water may be drained through a valve in the back of the instrument.

(3) Swing the crane to the right, back into place. Be sure the thumbscrew that locks the crane goes into the hole in the crane. A slightly depressed groove in the crane will help to gauge this. This hole centers the pulleys and puts them at the right height.

(4) Pass the counterweight cord over the pulleys and reconnect the end to the bell as before, being careful not to raise the bell.

e. Charge with oxygen. (1) Slip the oxygen yoke over the neck of the cylinder. Place it so the projection where the tube attaches to the yoke fits into the outlet hole of the oxygen cylinder. There should be a washer at this connection.

(2) Tighten the thumbscrew.

(3) Connect rubber tube between yoke and oxygen stopcock near base of thermometer.

(4) Open oxygen stopcock.

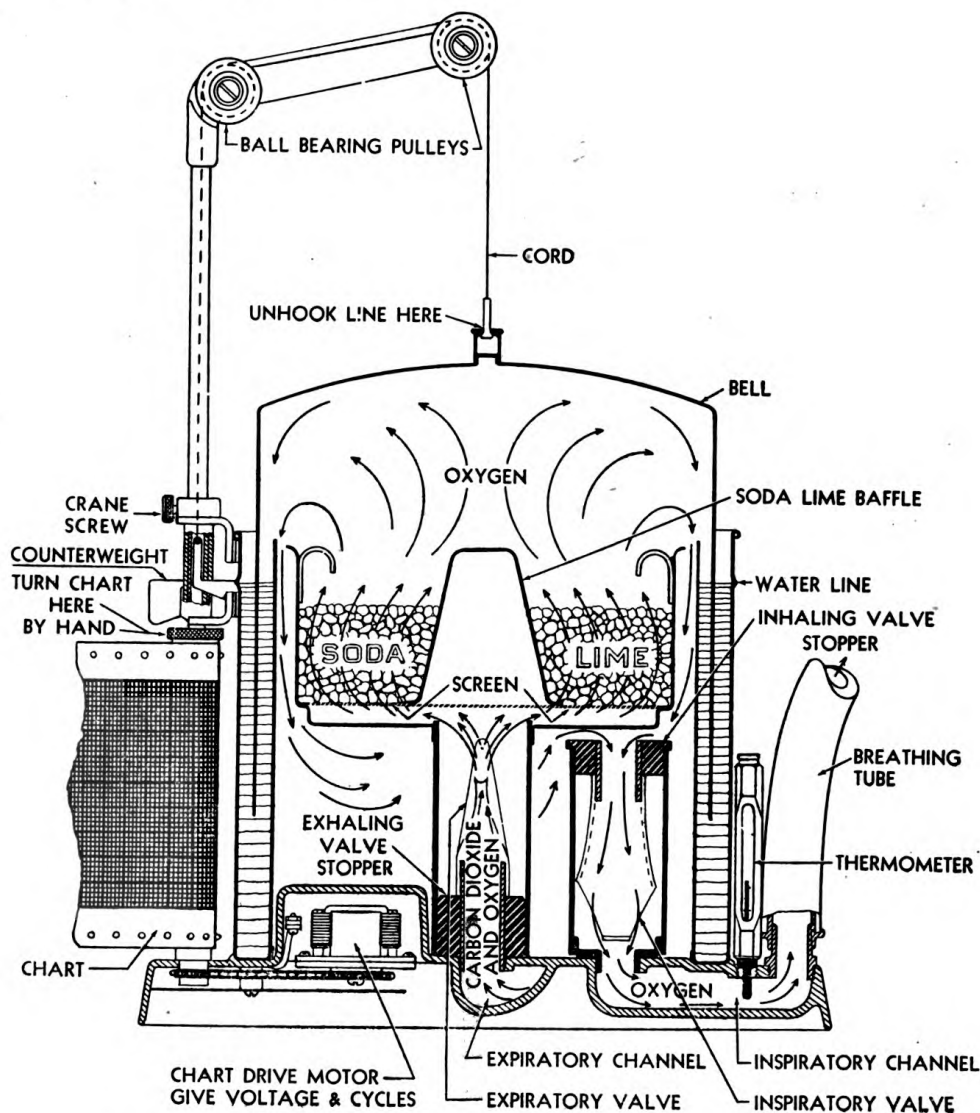


Figure 3. Cross section of McKesson Recording Water Type Metabolor.

(5) Open valve on oxygen cylinder allowing oxygen to enter the bell slowly.

(6) Close Y-piece inhaler shut-off valve.

(7) When bell is near the top, and counterweight is near the bottom of the upright over which it slides, close the valve on the oxygen cylinder.

(8) Close oxygen stopcock.

f. Adjust pen. Before starting test, lower pen carrier mounted on counterweight until it is level with the top of the weight or until it strikes the base when the weight is down. This brings the pen to the

base line. Put a drop of oiled ink in the pen and bring the pen against the chart roll.

g. Test chart. (1) A new apparatus comes with chart roll in place. See that the holes in the paper engage the studs on the feed roll. Insert male plug of the line cord into the power supply receptacle. Turn toggle switch on at base. The chart should run at the rate of 1 inch per minute.

Note: The chart motor is a synchronous self starting motor and its speed is dependent upon the number of cycles of the current being used. Therefore the motor will operate correctly only on the number of cycles for which it was designed.

- (2) Breathe into apparatus to see if pen writes.
- (3) Turn toggle switch off at base.
- (4) Move pen away from chart.
- (5) Pull chart against metal and tear off strip just used.

h. Place near patient. Place the apparatus near the head of the bed in a position where the flexible arm and breathing tubes extend toward the patient's mouth.

i. Adjust inhaler to patient. (1) *Face masks.* There are two sizes of face masks, the smaller for women and children, and the larger for men. The face mask is held in place by a harness about the head and snapped on with glove fasteners. The pneumatic cushion on the mask must not be blown up tight; merely open the valve and the air will fill the cushion properly, then close the valve to keep the air in. This should be done before the mask is put on. When applied, the face mask should fit airtight, but not so tight as to be uncomfortable. The mask should be applied to the patient before it is connected to the Y-piece inhaler. After the mask is adjusted so that it makes an airtight adaptation to the patient, connect Y-piece inhaler to mask by bending the flexible metal tube support to bring the Y-piece inhaler into position to attach it to the mask without pull or stress on it. To lubricate the rubber face masks so that they will slip on the Y-piece inhaler easily, use water not grease. If it is difficult to adapt the face masks to a patient, the mouthpiece may be preferred in some cases.

(2) *Mouthpieces.* There are two sizes of mouthpieces, the smaller for women and children, the larger for men. The mouthpiece flange fits under the lips and outside of the teeth. The seal thus made is airtight as long as the patient cooperates to make it so. To connect the mouthpiece, have the patient set the flange between the teeth and the lips, with the two projections between the teeth. This must be done before the mouthpiece is connected to the Y-piece inhaler. After it is adjusted so that it makes an airtight adaptation to the patient, connect Y-piece inhaler by bending the flexible metal breathing tube support so that there is no strain on the mouthpiece.

(3) *Spring nose clip.* The nose must be clamped shut with the spring nose clip when mouthpieces are used. Be sure it holds the nose shut by applying it below the bony portion of the nose.

- 11. OPERATION DURING TEST.** **a.** Move pen against chart paper.
b. Snap the toggle switch to the ON position, thus starting the rotation of the chart.
c. Open the Y-piece inhaler *fully*. (See fig. 2.)
d. Allow the patient to breathe in and out four or five times.
e. Push the square rod carrying the pen down to the base, which puts the pen on the zero line of the chart.
f. Conduct the test.

- 12. OPERATION AFTER TEST.** **a.** Turn the toggle switch to the OFF position.
b. Pull pen away from chart.
c. Turn knurled knob at the top of roller until used paper has cleared metal plate.
d. Tear off used portion of chart against flat metal plate.

13. PRECAUTIONS TO BE TAKEN BEFORE AND DURING TEST.

a. To prevent water from getting inside unit. (1) Do not pull up bell too rapidly. This bell should be pulled up very slowly when the Y-piece inhaler shut-off valve is open and should *never* be pulled up when this valve is closed.

(2) Never overflow the moat with water.

(3) Do not pull up bell when breathing flutter valve is stuck under soda lime.

(4) Do not roll machine over uneven flooring.

(5) Be sure the machine is leveled properly when in operation. If it is unbalanced the bell is likely to scrape the sides. In such a case the bell would pick up water on the upward stroke and scrape it into the center on downward stroke.

b. To prevent carbon dioxide accumulations with new soda lime unit. (1) Check flutter type breathing valves to see that they are not standing open.

(2) Check soda lime canister to see that it is seated firmly.

c. To prevent pen from staying at bottom during test. (1) Be sure that the spring clip holding pen assembly to counterweight has not been bent allowing the whole assembly to drop down.

(2) Be sure the crane has been placed high enough. The thumb-screw which locks crane should be inserted in the hole in the crane upright.

(3) Adjust the length of counterweight cord properly. (See par. 47.)

(4) Do not overflow the bell with oxygen.

(5) Be sure Y-piece inhaler shut-off valve is open when machine is in operation. If it is closed or partially closed, a bad leak will occur.

(6) Be sure both oxygen and cylinder valves are completely closed.

Caution: Close oxygen valve first.

CHAPTER 3

OPERATING INSTRUCTIONS, SANBORN

Section I. GENERAL

14. SCOPE. This chapter contains information for the guidance of the personnel responsible for the operation of the Sanborn Waterless Metabolism Tester. It contains information on the operation of the equipment with the description and location of the controls and instruments.

Section II. SERVICE UPON RECEIPT OF EQUIPMENT

15. NEW EQUIPMENT. a. Unpacking. (1) *To unpack apparatus.*

(a) Open the packing box and pull the inner shell straight up and out.

(b) Grasp the flexible breathing tube support and pull out apparatus with its packing base board.

(c) Remove the packing base board from the apparatus.

(d) Save packing box and its contents during trial period.

(2) *To unpack stand.* (a) Open the packing box and pull the inner shell straight up and out.

(b) Lift the stand straight out.

(c) Barometer and pressure gauge measuring chamber, if ordered, will be underneath the box cover under the legs of the stand. If flexible oxygen tubing, yoke, and handwheel are not mounted on oxygen tank, they are also underneath the box cover under the legs of the stand.

(d) Be sure all parts are removed from the packing box.

b. Assembling. (1) *To mount oxygen cylinder.* (a) Slip the oxygen yoke over the neck of the cylinder. Place it so the projection where the tube attaches to the yoke fits into the outlet hole of the oxygen cylinder (fig. 4). There should be a washer at this connection.

(b) Tighten the thumbscrew.

(c) Lower the cylinder into the cylinder holder of the stand. The oxygen tube should project toward the flat bracket which is attached to one of the arms of the stand.

(d) Adjust the yoke so that the pins fit into the holes in the rim of the cylinder holder.

- (e) Place the handwheel in position.
- (2) *To mount apparatus.* (a) Grasp the base and tilt the tester until the hooks underneath can be seen (looking from the flexible arm end). (See fig. 5.)

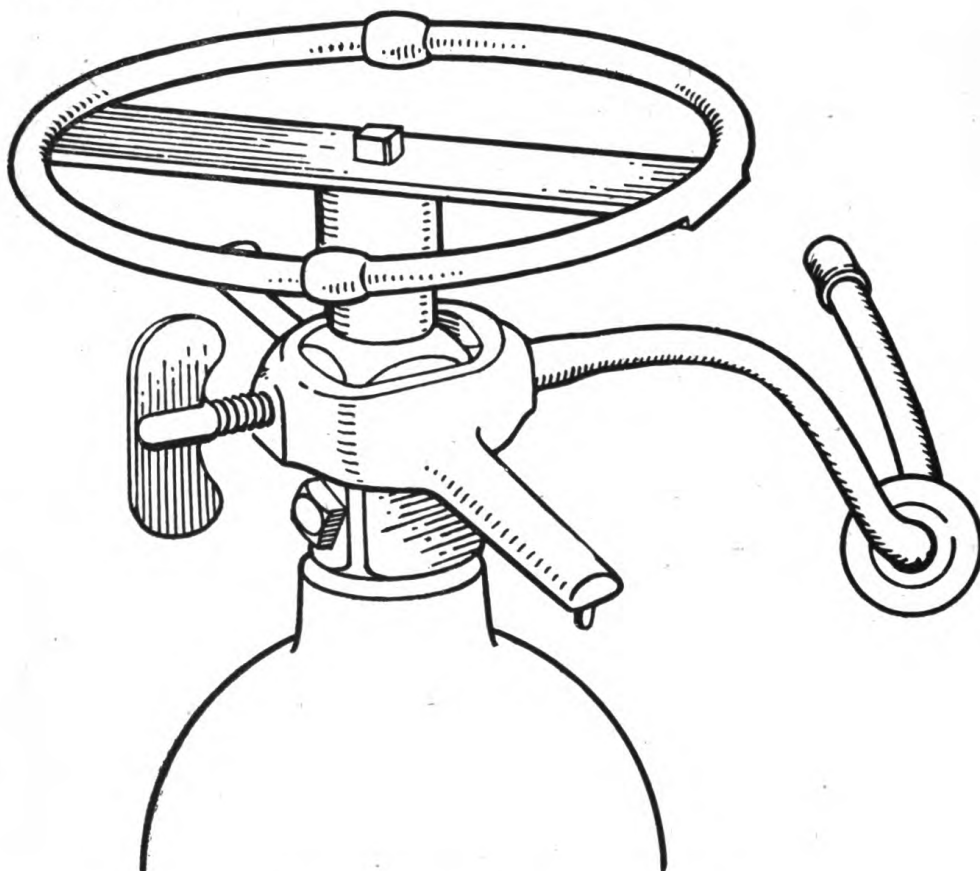


Figure 4. Oxygen cylinder yoke connection.

- (b) Slide both hooks on to the cross rod of the stand.
- (c) Lower the tester so the oxygen inlet in its base enters the hole in the bracket of the stand.
- (3) *To connect oxygen cylinder.* (a) Insert the end of the flexible oxygen tube into the oxygen inlet on the bottom of the tester. (See fig. 6.)
- (b) Slide the clamp nut up on the tube and screw it up to make a firm, tight connection.
- (4) *To connect pressure gauge and measuring chamber.* (a) Insert the nipple at the top of the measuring chamber into the oxygen inlet on the bottom of the apparatus. (See fig. 7.)
- (b) Slide up the clamp nut and screw it up to make a firm, tight connection.
- (c) There must be a small rubber washer in the inlet to seal the connection.
- (d) Insert the end of the flexible oxygen tube to the bottom of the measuring chamber.

(e) Slide the clamp nut up on the tube and screw it up to make a firm, tight connection.

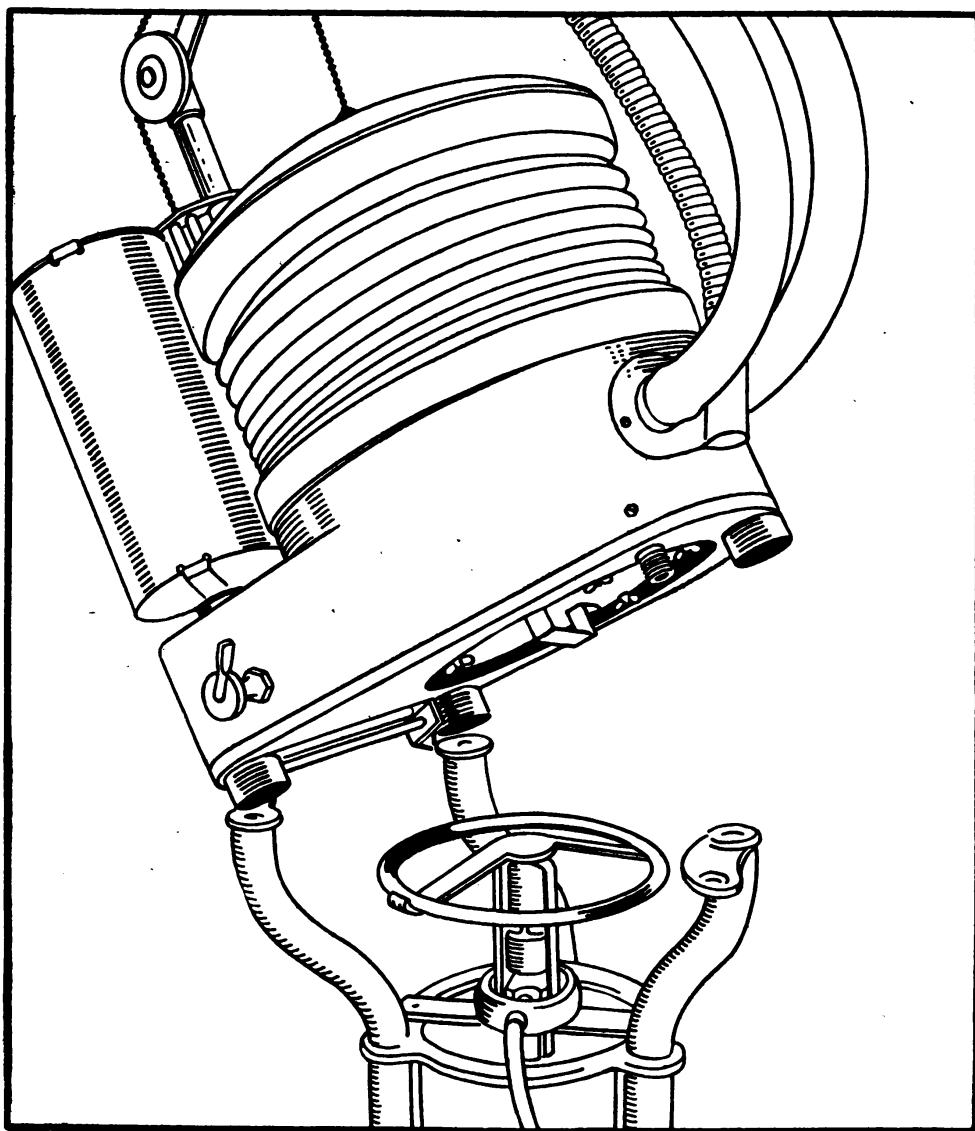


Figure 5. Position for attaching apparatus to stand.

16. USED EQUIPMENT. The same procedure should be followed as for new equipment. (See par. 15.)

Section III. CONTROLS AND INSTRUMENTS

17. CONTROLS. α. Handwheel. The handwheel, when attached to the oxygen cylinder, regulates the flow of oxygen from the cylinder.

b. Oxygen valve. The oxygen valve, in the base of the apparatus beneath the chart cylinder, regulates the flow of oxygen from the flexible oxygen tube or measuring chamber to the bellows.

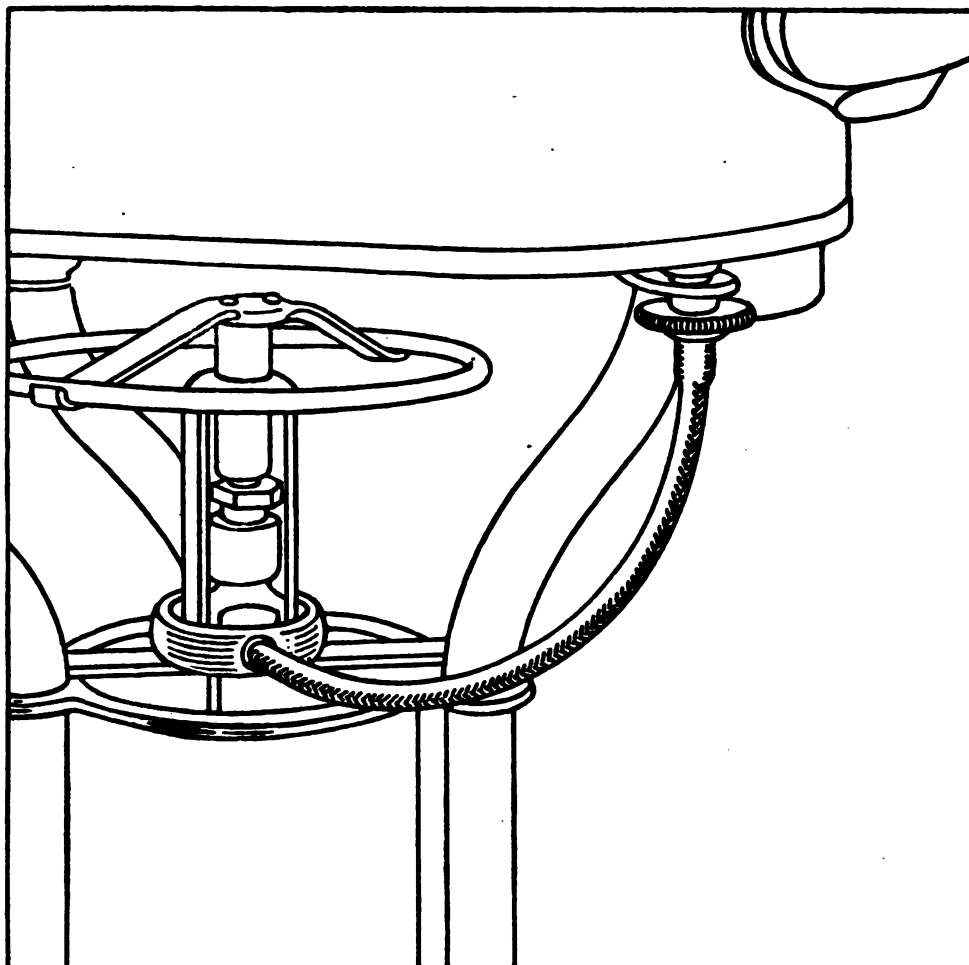


Figure 6. Direct connection oxygen cylinder to apparatus.

c. Toggle switch. The toggle switch, on the base near the chart cylinder, starts and stops the chart cylinder and the motor blower.

d. Breathing valve. The breathing valve, when in the OFF position, closes off the ends of the breathing tubes and allows the patient to breathe into the atmosphere. In the ON position, the patient breathes directly into the tester. Turn the breathing valve clockwise for ON position, counterclockwise for OFF position.

18. INSTRUMENTS. a. Thermometer. The thermometer, mounted on the base, indicates (in degrees centigrade) the temperature of the oxygen in the tester.

b. Pressure gauge. The pressure gauge, mounted on the measuring chamber, indicates the amount of oxygen in the measuring chamber. The pressure gauge corrects for temperature and atmospheric pressure.

c. **Red pilot light.** The red pilot light glows when the toggle switch is on.

d. **Barometer.** The barometer, which is separate, indicates the bar-

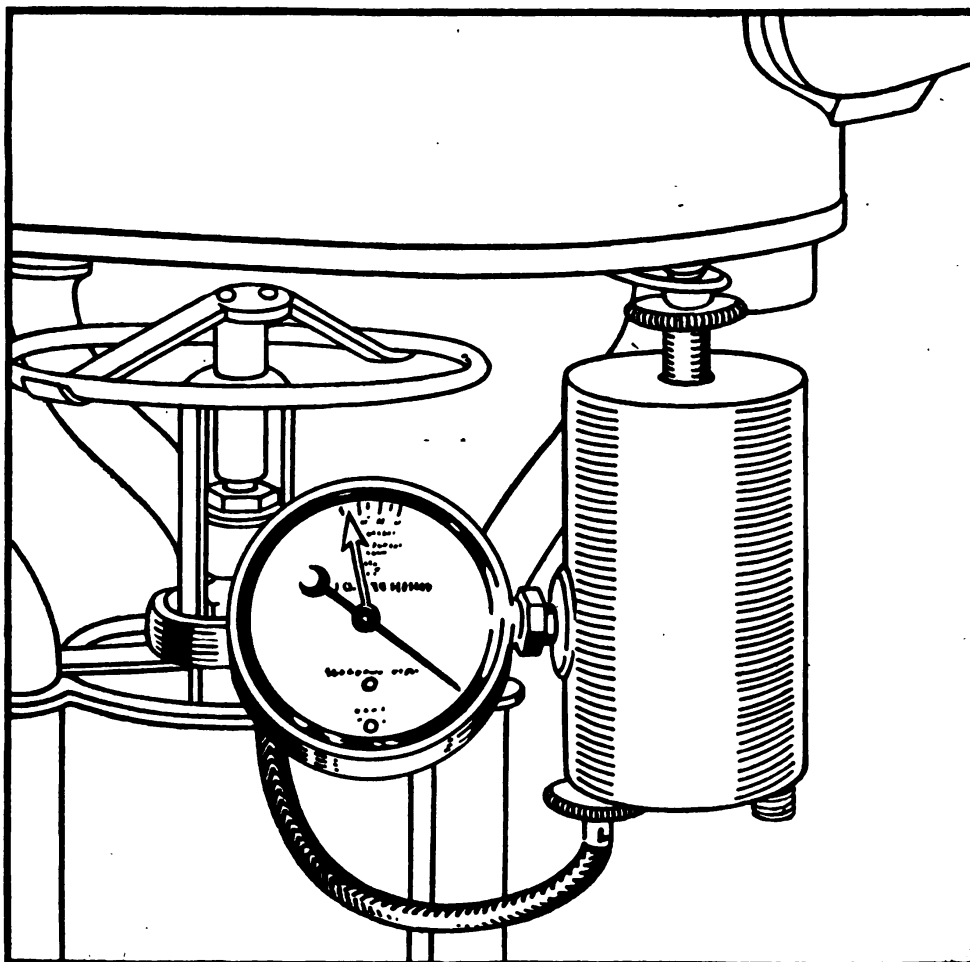


Figure 7. Pressure gauge and measuring chamber connection.

ometric pressure for use in computing the metabolic rate of the patient. It is not included in models designated "1943" or later.

Section IV. OPERATING UNDER USUAL CONDITIONS

19. GENERAL. Prior to November 1943, there were two methods used for measuring the patient's basal metabolic rate with the Sanborn Waterless Metabolism Tester. One method put an unmeasured amount of oxygen at the disposal of the patient, and the rate of oxygen consumption per minute was computed by the patient's chart and slope line. This involved the use of both a thermometer and barometer. The other method was based upon the length of time it took a patient

to consume a fixed premeasured volume of oxygen. This method utilized a measuring chamber and a pressure gauge which compensated for both temperature and pressure. Therefore, there was no need for a barometer. After November 1942, the barometer was not included with the Sanborn Waterless Metabolism Tester. Thus models designated "1942" differ from those designated "1943" in that the "1942" unit is supplied with a thermometer and barometer and has two optional means of determining the patient's basal metabolic rate.

20. PREPARATION OF APPARATUS FOR OPERATION USING AN UNKNOWN AMOUNT OF OXYGEN.

a. Place a fresh chart on the cylinder. (1) Lift chart cylinder from its spindle.

(2) Slide out chart-holding clips.

(3) While holding cylinder *upside down*, wrap a chart around it, right side up.

(4) Slide right edge, marked "this edge underneath," under the clips, bring left edge around and overlapping right edge; adjust chart to fit snugly on the cylinder and close the clips to hold it.

(5) Slide cylinder down on the spindle, pushing it firmly over the ball friction grip until it reaches the bottom of the spindle.

(6) Turn the cylinder counterclockwise until the stylus has just crossed the overlap of the chart. (See fig. 8.)

Caution: To prevent unwanted marks hold stylus away from the chart whenever the cylinder is being moved.

b. Admit oxygen. (1) Turn breathing valve clockwise.

(2) Press bellows down nearly as far as it will go.

(3) Turn breathing valve counterclockwise.

(4) Open oxygen valve handwheel slowly counterclockwise until oxygen enters the bellows. The writing point will fall as the bellows fills. Admit oxygen *slowly*. Enough oxygen for testing the average patient will raise the upper edge of the bellows to the level of the cylinder top. (See fig. 8.) More oxygen may be admitted for a large person or a suspected exophthalmic case.

(5) Close oxygen cylinder valve by turning handwheel clockwise.

(6) Close oxygen valve.

c. Move apparatus near patient. Place the apparatus near the head of the bed in a position where the flexible arm and breathing tubes extend toward the patient's mouth.

d. Connect mouthpiece. (1) Turn the breathing valve to the OFF position.

(2) Moisten the neck of a sterilized rubber mouthpiece by dipping halfway into a glass of water.

(3) Slip the wet stem on to the projecting end of the breathing valve. Place it at the correct angle to fit the patient's mouth. Adjust the mouthpiece by sliding the tubes in or out and by twisting the mouthpiece until it lies just above and parallel to the lips.

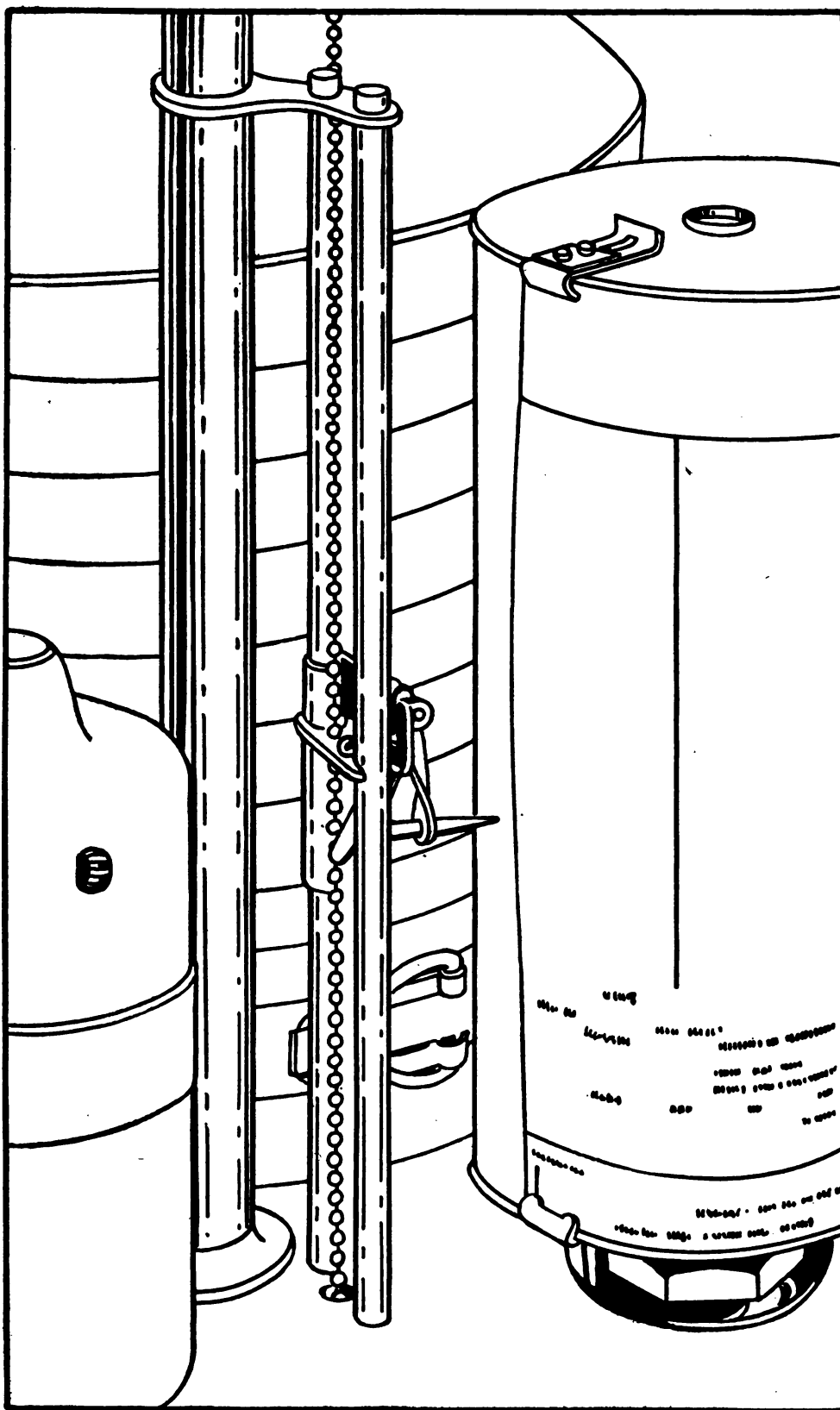


Figure 8. Position of pen for beginning test.

(4) Have the patient set the flange of the mouthpiece between the teeth and the lips and with the two projections between the teeth.

(5) Adjust the flexible arm so that the mouthpiece does not tend to pull away from the patient's mouth.

(6) Keep the breathing tubes as straight as possible. Bent tubes interfere with free circulation.

e. Adjust noseclip. (1) Turn the thumbscrew so that the sponge pads are about a finger's width apart.

(2) Fit the pads on the patient's nose, well down over the nostrils.

(3) Tighten the noseclip enough so that the pads will close the nostrils without causing the patient discomfort.

f. Test for leaks. (1) Put the leak tester in a glass of cold water.

(2) When the leak tester is cool, take it out, wipe it dry, and test it by breathing on it; if the temperature is correct a fog will appear and slowly disappear.

(3) Hold the leak tester close under the nostrils, tilted up toward the tip of the nose, but do not allow the mirror surface to touch the skin. Fogging on the metal mirror will show the exact source of any leak.

(4) Adjust the position of the pads and the tension of the noseclip until no fogging appears.

(5) Hold the leak tester at each corner of the mouth, using the above method of checking leakage.

21. OPERATION DURING TEST. a. Start motors. Turn the toggle switch to the ON position. This will start both the motor-blower and chart motor. The red light glows when the switch is on. The chart cylinder should make one revolution in 10 minutes.

Note: The chart motor is a synchronous self-starting motor and its speed is dependent upon the number of cycles of the current being used. Therefore, the motor will operate correctly only on the number of cycles for which it was designed.

b. Turn breathing valve on. Turn breathing valve clockwise. This connects the patient to the oxygen in the bellows which rises and falls with the breathing.

c. Conduct test.

22. OPERATION AFTER TEST. a. Turn breathing valve off.

b. Stop motors. Turn toggle switch to the OFF position. This will stop the motor-blower and chart motor. The red light will go out.

c. Disconnect patient.

d. Remove chart from cylinder. (1) Lift chart cylinder from its spindle.

(2) Slide out chart-holding clips.

(3) Remove chart from cylinder.

(4) Replace cylinder down on the spindle, pushing it firmly over the ball friction grip until it reaches the bottom of the spindle.

23. PREPARATION OF APPARATUS FOR OPERATION USING KNOWN MEASURED AMOUNT OF OXYGEN. It is necessary to use the measuring chamber and pressure gauge for this method of determining basal metabolic rates. (See par. 19.)

a. Place a fresh chart on the cylinder. See paragraph 20a.

b. Admit oxygen. (1) Turn breathing valve clockwise.

(2) Press bellows down nearly as far as it will go.

(3) Turn breathing valve counterclockwise.

(4) Open oxygen valve.

(5) Turn oxygen cylinder valve handwheel slowly counterclockwise.

Allow oxygen to enter the bellows until the writing point is about 3 inches (less in higher altitudes) below the top of the chart.

(6) Close oxygen valve. Pressure will now build in measuring chamber. When black hand of gauge comes directly over the red temperature hand, close oxygen cylinder valve by turning oxygen cylinder valve

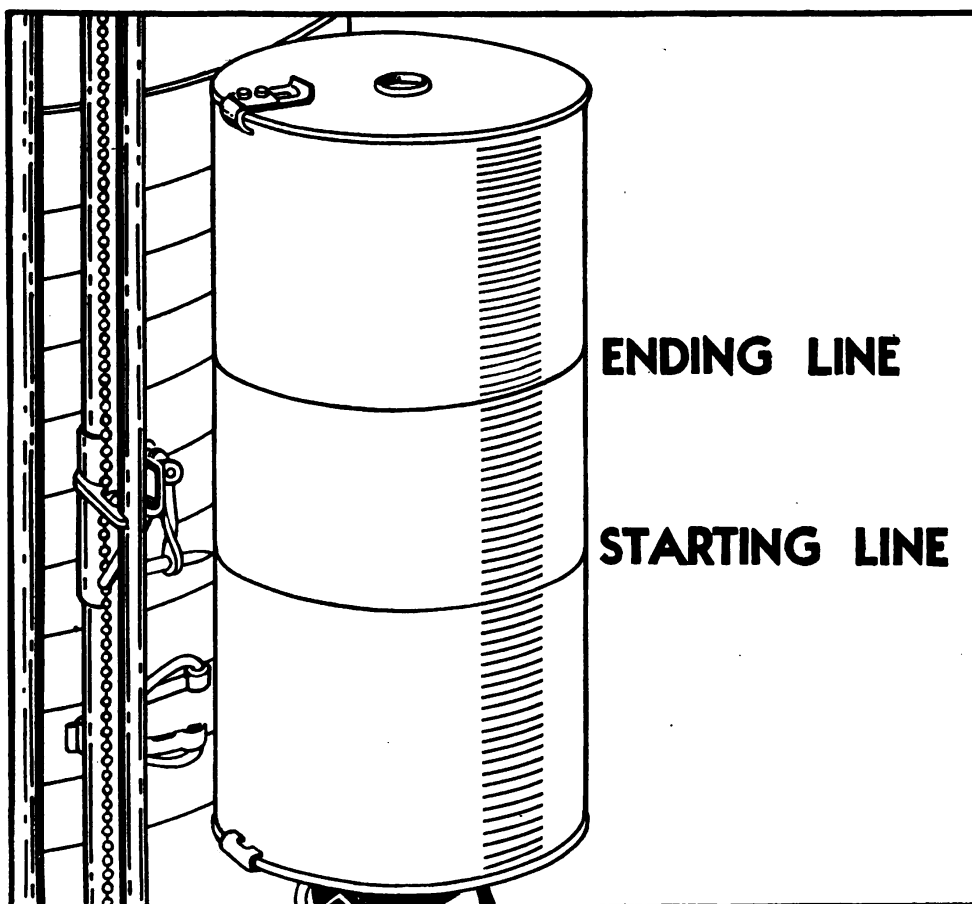


Figure 9. Tracing line around chart.

handwheel clockwise. If black hand goes beyond the red one, release the excess of oxygen by opening the oxygen valve slightly and briefly. Tap gauge to get an accurate reading.

(7) Allow the tester to stand this way for 15 seconds or so. If the

black hand does not remain directly over the red one, a leak is indicated.

(8) Turn chart cylinder counterclockwise one full turn by hand to trace a line around the chart.

(9) Open bellows valve to admit oxygen slowly from measuring chamber to bellows.

(10) Turn cylinder counterclockwise one full turn by hand to trace a second line around the chart. (See fig. 9.)

(11) Admit more oxygen to the bellows from the oxygen cylinder to lower the writing point about $\frac{1}{2}$ inch.

c. Move apparatus near patient. See paragraph 20c.

d. Connect the mouthpiece. See paragraph 20d.

e. Adjust the noseclip. See paragraph 20e.

f. Test for leaks. See paragraph 20f.

24. OPERATION DURING TEST. **a. Start the motors.** See paragraph 21a.

b. Turn on breathing valve. Turn the breathing valve clockwise at the end of the patient's exhalation. This will start the tracing with an upward stroke of the writing point.

c. Conduct test until respiration record has crossed both of the horizontal lines.

25. OPERATION AFTER TEST. See paragraph 22.

CHAPTER 4

MAINTENANCE INSTRUCTIONS, McKESSON

Section I. GENERAL

26. SCOPE. This chapter contains information for the guidance of the personnel of the using organizations responsible for the maintenance (1st and 2d echelon) of the McKesson Recording Water Type Metabolizer, Model No. 176. It contains information needed for the performance of preventive maintenance services.

Section II. LUBRICATION

27. LUBRICATION. **a.** Do not oil rollers on the chart assembly.
b. Do not oil synchronous electric motor.

Section III. PREVENTIVE MAINTENANCE SERVICES

28. GENERAL. Preventive maintenance services as prescribed by Army Regulations are a function of using organization echelons of maintenance.

29. BEFORE OPERATION SERVICE. **a.** Check that soda lime container has fresh granules which are not caked together. (See par. 56.)
b. Check water level in moat. (See par. 10d.)
c. Check pen for ink.
d. Make sure there is sufficient chart paper for the test.

30. DURING OPERATION SERVICE. Watch breathing of patient to determine freshness of soda lime. (See par. 55.)

31. AFTER OPERATION SERVICE. **a.** Disconnect electric cord from outlet and coil up so it is not on the floor.

- b. Drain water from moat. (See par. 7d.)
- c. Remove and sterilize face mask or mouthpiece, Y-piece inhaler, and rubber breathing tubes. (See par. 52.)
- d. Remove soda lime if apparatus is not to be used for several hours. (See par. 10b.)
- e. Wipe out any moisture or dirt in unit. (See par. 53.)
- f. Replace Y-piece inhaler and rubber breathing tubes.
- g. Close the oxygen stopcock and Y-piece inhaler shut-off valve.
- h. Put a thin coating of petrolatum or grease, lubricating, special (GL) on guide for counterweight.

Section IV. TROUBLE SHOOTING

32. GENERAL. When results are obtained which are different from those reasonably to be expected, perform one or two complete tests, including the computation, on some person whose basal metabolic rate is about normal and who is in a basal condition when tested.

33. RESULTS OF TESTS HIGHER THAN EXPECTED.

<i>Possible cause</i>	<i>Possible remedy</i>
a. Outward leakage.	Repair leak. (See par. 35.)
b. Patient in nonbasal condition.	Have patient in basal condition.
c. Speed of chart too slow.	Check source of current to make sure it is supplying the correct number of cycles as stamped on the nameplate of the apparatus. (See par. 10g.)

34. RESULTS OF TESTS LOWER THAN EXPECTED.

<i>Possible cause</i>	<i>Possible remedy</i>
a. Failure to absorb carbon dioxide due to exhausted soda lime.	Test soda lime and replace with fresh soda lime if necessary. (See par. 56.)
b. Failure to absorb carbon dioxide due to blocked circulation.	Test flutter valves. (See par. 10c.)
c. Speed of chart cylinder too fast.	Check source of current to make sure it is supplying the correct number of cycles as stamped on the nameplate of the apparatus. (See par. 10g.)

35. OUTWARD LEAKS IN APPARATUS.

<i>Possible cause</i>	<i>Possible remedy</i>
a. Water level low.	Add water. (See par. 10d.)
b. Y-piece inhaler valve not open fully.	Open fully.
c. Disconnected hose.	Connect hose.

36. CARBON DIOXIDE IS ACCUMULATING WITH NEW SODA LIME UNIT.

<i>Possible cause</i>	<i>Possible remedy</i>
a. Flutter type breathing valves are standing open.	Inspect and replace if necessary. (See par. 42.)
b. Soda lime canister not seated firmly.	Remove and reset canister. (See par. 43.)

37. PEN DIGS INTO PAPER.

<i>Possible cause</i>	<i>Possible remedy</i>
Dried ink in hinge of pen.	Clean hinge. (See par. 46.)

38. WATER INSIDE UNIT.

<i>Possible cause</i>	<i>Possible remedy</i>
a. Carelessness of operator.	Observe precautions in paragraph 13.
b. Breathing valve stuck under soda lime and bell lifted.	Remove soda lime container and reset.
c. Leak in moat.	Refer to higher echelon.
d. Pouring water in moat without bell in place.	Replace bell before adding water.

39. PEN STAYS AT BOTTOM.

<i>Possible cause</i>	<i>Possible remedy</i>
a. Spring clip that holds pen assembly has been bent so the whole assembly drops down.	Bend clip into position. (See par. 44.)
b. Crane not placed high enough.	Raise crane. (See par. 45.)
c. String is too long.	Shorten string. Replace string. (See par. 47.)
d. Bell has been over-filled with oxygen.	Let out some oxygen.
e. Bad leak.	Look for open valve or disconnected hose. Leaks should be referred to higher echelon for repair.
f. Oxygen valve is left open and tank valve is not completely off.	Close both valves.

40. PAPER HANGS IN GUIDE.

Possible cause

Possible remedy

- | | |
|---|--|
| <p>a. Perforated holes not meshing with small studs on roller.</p> <p>b. Sharp corners on guide plate catch perforations.</p> | <p>Match holes to studs.</p> <p>Adjust guide plate until surface is parallel with top of roll.</p> |
|---|--|

41. SODA LIME CAKES.

Possible cause

Possible remedy

- | | |
|---|---|
| <p>Soda lime left in container for too long a period.</p> | <p>Break up cakes or replace. (See par. 10b.)</p> |
|---|---|

Section V. MAINTENANCE OPERATIONS

42. TO ADJUST LEAKY FLUTTER TYPE VALVES. **a.** Flutter type breathing valves may become cured in the open position and should be pinched inward where they connect to the tubular connection.

b. Inspect to see if some obstruction is caught in the valve. If so, removal will often correct the leak.

43. TO ADJUST SODA LIME CANISTER. If the soda lime canister does not seat firmly remove and set in place again. It should be given a slight twist to seat it firmly.

44. TO REPAIR CLIP HOLDING PEN ASSEMBLY. **a.** If the clip that holds the pen assembly has been bent so the whole assembly drops down, remove both screws that hold the spring clip.

b. Bend the spring at the end that touches the pen staff.

c. Replace clip.

45. TO RAISE CRANE. Raise the crane until it is possible to fit the knurled thumbscrew into the hole in the crane upright. A slightly depressed groove in the crane will help to gauge the proper position.

46. TO CLEAN PEN ASSEMBLY. **a.** If the pen is overfilled with ink, it will run down into the hinge of the pen. After the ink dries the hinge will work stiffly, making the pen dig into the paper, or not write properly.

b. With the string attached, push the bell down to the bottom. This will bring the weight and pen assembly to the top.

c. Grasp the lower part of the pen assembly and pull it straight down, not to the side.

- d. Remove the small screw that holds the pen and clean the male and female parts of the hinge with brush and water.
- e. Replace pen on hinge.
- f. Replace small screw and adjust so that the pen will drop freely but has very little side play.
- g. Adjust the backstop so that it stops the backward swing of the pen just after it falls back of top center.
- h. Push the pen assembly straight up in its groove in the weight.

47. TO REPLACE A STRING. α. Disconnect string from the bell.

b. Unscrew thumbscrew and pull crane with pulleys straight up. The old string with metal tip will feed through the hollow part of the crane. Have someone hold the weight at the top or put a stick under the weight so it will stay at the top.

c. Cut old string from eye in top of the weight and tie new one in place. Do not leave excess string after the knot is tied. Be sure that the eye is exactly in the center.

d. Feed new string back through hollow part of the crane.

e. Put crane in place. Be sure the thumbscrew that holds the crane goes into the hole in the crane. A slightly depressed groove in the crane will help to gauge this position. This hole helps to center the pulleys and puts them at the proper height.

f. Thread the spring into the metal tip. Cut the string at an angle and it will go into the tip easily.

g. With the weight still at the top and the bell at the bottom, place the string over the pulleys, set the metal tip on the string so that it just goes into the slot in the bell.

h. Bend the string sharply so as to mark it at this point and tie a knot there. Cut off the excess string.

48. TO REPLACE FLUTTER TYPE BREATHING VALVES. α. Remove bell and soda lime container. (See par. 10b.)

b. Remove old valve on center valve support.

c. Replace with new valve in the same position.

d. Remove rubber valve carrier from inside large metal valve container.

e. Replace with new valve.

f. Replace soda lime container and bell. (See par. 10b and d.)

g. If, after reassembling, the valves make a noise, change their positions on their supports.

h. Be sure cut edges of valves are in contact with each other to preclude leaks.

49. TO REPLACE ELECTRIC MOTOR. α. Be sure new motor is the proper one for voltage and current.

b. Remove bell and soda lime container. (See par. 10b.)

- c. Lay metabolism apparatus on its side.
- d. Disconnect motor wires by removing composition connectors.
- e. Remove the three screws which hold the motor and gear plate in position.
- f. Put new motor and gear plate in place and check to see that the drive gear meshes perfectly with gear on drive roller. These gears should mesh loosely, not tight.
- g. Tighten motor and gear plate.
- h. Connect motor wires by means of composition connectors.

50. TO REPLACE PEN. See paragraph 46.

51. TO REPLACE BELL. See paragraph 10d.

52. TO STERILIZE FACE MASK, MOUTH PIECE, Y-PIECE INHALER, AND RUBBER BREATHING TUBES. All these articles are of rubber or partly of rubber. Sterilize the same as other rubber goods.

53. CLEANING. a. The unit should be kept clean both inside and out. Wipe off the outside and inside with a damp cloth and then a dry cloth.

b. Small particles of soda lime which have adhered to the metal parts should be removed by brushing with a stiff brush, taking care not to damage any parts.

c. Moisture should be removed as much as possible. A very small amount of water will accumulate in the extreme bottom (below breathing tube connections) of the machine. To remove this, disconnect breathing tubes, tilt machine and remove water with an eye dropper.

54. TO CHANGE PAPER. a. A new apparatus comes with the chart roll in place.

b. To replace used roll with a new roll when the used roll is still on the feed roll—

(1) Remove old core from the holder.

(2) Place new roll on the holder.

(3) Glue old chart paper to new chart, being careful that the holes coincide.

(4) Turn toggle switch ON and let the paper run through.

(5) Tear off excess paper against flat plate.

c. To replace used roll after it has been removed from the feed roll—

(1) Cut the end of the paper into a long "V".

(2) Place new roll right side up on upright holder.

(3) Feed the point of the "V" around the roll, being careful that corresponding holes at the top and bottom of the paper pass over the studs.

(4) Turn the feed roll at the top with the fingers.

(5) When threaded over the feed roll, slip paper into the table grooves, top and bottom.

55. TO TEST SODA LIME (WITH PATIENT). Soda lime absorbs carbon dioxide from the exhaled gases. There comes a time eventually when the granules will not absorb carbon dioxide. When this occurs, the patient sighs frequently or progressively increases the depth of respiration which is shown by the increasing length of respiration strokes on the chart. This is not evident until the patient has been breathing for about 2 minutes. The patient notices a sensation of difficult breathing at the latter part of the test. When this occurs the old soda lime should be replaced as described in paragraph 10b.

56. TO TEST SODA LIME (NO PATIENT). **a.** Pour a half glass of fresh lime water into a shallow pan.

b. Turn Y-piece inhaler shut-off valve ON.

c. Exhale into the Y-piece inhaler until the bell is filled. Quickly turn the Y-piece inhaler valve OFF to retain the air in the bellows.

d. Lower Y-piece inhaler into the lime water.

e. Turn Y-piece inhaler valve ON so that the air bubbles through the lime water when the bell is pushed down.

f. Pour the solution back into a glass. If the solution becomes cloudy or a white precipitate forms, carbon dioxide is present and the soda lime should be replaced.

CHAPTER 5

MAINTENANCE INSTRUCTIONS, SANBORN

Section I. GENERAL

57. SCOPE. This chapter contains information for the guidance of the personnel of the using organizations responsible for the maintenance (1st and 2d echelon) of the Sanborn Waterless Metabolism Tester. It contains information needed for the performance of preventive maintenance services.

Section II. LUBRICATION

58. LUBRICATION. **a.** Put a few drops of OIL, lubricating, preservative, special (PS) in oil cup on the motor blower every 3 months.

b. Do not oil clock motor used to turn chart cylinder.

c. Do not oil guide rods.

Section III. PREVENTIVE MAINTENANCE SERVICES

59. GENERAL. Preventive maintenance services as prescribed by Army Regulations are a function of using organization echelons of maintenance.

60. BEFORE OPERATION SERVICE. **a.** Check that soda lime container has fresh granules which are not caked together.

b. Provide a glass of cold water for leak tester.

c. Check circulation. (See par. 73.)

d. If capillary pen is being used, see that the ink well is filled.

61. DURING OPERATION SERVICE. **a.** Watch breathing of patient to determine freshness of soda lime. (See par. 75.)

b. Test mouthpieces and nose clips for leaks once during test. (See par. 20f.)

62. AFTER OPERATION SERVICE. a. Remove and sterilize mouth-piece, breathing valve, and rubber breathing tubes. (See par. 88.)

b. Remove soda lime if apparatus is not to be used for several hours. (See par. 78.)

c. After sterilizing the breathing valve, dry the parts carefully and put a fresh coating of petrolatum or grease, lubricating, special (GL) on the contacting surfaces.

d. Wipe off any moisture or dirt on tester. (See par. 89.)

e. If capillary pen is used, clean thoroughly. (See app. II.)

f. Replace breathing valve and rubber breathing tubes.

g. Turn the breathing valve off.

h. Turn the oxygen valve off.

i. Replace cloth cover over unit.

63. WEEKLY INSPECTION AND SERVICE. a. Clean the vertical rods which guide the writing point carriage and see that all parts of the mechanism have proper freedom of movement.

b. Clean with carbon tetrachloride or xylol. *Never oil guide rods.*

c. Examine stylus for wear.

64. QUARTERLY SERVICE. Lubricate. (See par. 58.)

Section IV. TROUBLE SHOOTING

65. GENERAL. When results are obtained which are different from those reasonably to be expected, perform one or two complete tests, including the computation, on some person whose basal metabolic rate is about normal and who is in a basal condition when tested.

66. RESULTS OF TESTS HIGHER THAN EXPECTED.

Possible cause

Possible remedy

a. Outward leakage.

Check for leakage in the tester and repair if possible. (See par. 74.)

b. Patient in nonbasal condition.

Have patient in basal condition.

c. Speed of chart cylinder too slow.

Check source of current to make sure it is supplying the correct number of cycles as stamped on the nameplate of the apparatus. (See par. 21a.)

67. RESULTS OF TESTS LOWER THAN EXPECTED.

Possible cause

Possible remedy

a. Failure to absorb carbon dioxide due to blocked circulation.

Test soda lima and replace with fresh soda lime if necessary. (See par. 76.)

- | | |
|---|---|
| b. Failure to absorb carbon dioxide due to blocked circulation. | Test for poor circulation and re-pair. (See par. 73.) |
| c. Speed of chart cylinder too fast. | Check source of current to make sure it is supplying the correct number of cycles as stamped on the nameplate of the apparatus. (See par. 21a.) |

68. POORLY MARKED CHARTS.

- | <i>Possible cause</i> | <i>Possible remedy</i> |
|--|---|
| a. Uneven stylus action. | Clean guides. (See par. 63.) |
| b. Unevenly worn stylus. | Replace stylus. (See par. 87.) |
| c. Stylus point loose. | Remove and adjust the holding springs of the socket until it is a firm fit. |
| d. Stylus point digs into the chart's surface. | Adjust stylus point. (See par. 91.) |

69. STYLUS CATCHES ON CHART.

- | <i>Possible cause</i> | <i>Possible remedy</i> |
|---------------------------------------|--|
| Chart placed on cylinder incorrectly. | Place chart on cylinder correctly. (See par. 20a.) |

70. BELLOWS TOP DOES NOT RETURN TO CENTRAL POSITION WITH BREATHING VALVE ON.

- | <i>Possible cause</i> | <i>Possible remedy</i> |
|--|---|
| Counterbalance tension adjusted incorrectly. | Adjust counterbalance tension. (See par. 77.) |

71. BELLOWS FILLS SLOWLY.

- | <i>Possible cause</i> | <i>Possible remedy</i> |
|---------------------------------|---|
| Oxygen cylinder becoming empty. | Replace with new oxygen cylinder. (See par. 15b.) |

72. PEN DOES NOT WRITE.

- | <i>Possible cause</i> | <i>Possible remedy</i> |
|----------------------------|------------------------------------|
| a. Pen not touching paper. | Move pen against paper. |
| b. Pen point plugged up. | Remove obstruction. (See app. II.) |
| c. Ink well empty. | Fill well with ink. (See app. II.) |

Section V. MAINTENANCE OPERATIONS

- 73. TO CHECK CIRCULATION.** a. Disconnect rubber breathing tubes from the tester.

- b. Start motors. Turn toggle switch to the ON position.
- c. Hold a lighted match at the breathing tube connection on the motor blower side. This should show a strong outward current of air which indicates that the blower is operating.
- d. Hold a lighted match at the other tube. This should indicate a strong inward current which indicates that there is a good circulation through the soda lime and bellows.
- e. If circulation is weak or there is none, check further.
 - (1) The soda lime should not be wet, caked, or packed tightly. If found in this condition, replace with new soda lime. (See par. 78.)
 - (2) Any moisture, precipitate, or obstruction should be removed from the tubes.

74. LEAKS IN THE APPARATUS. **α. Procedure.** (1) Put a fresh chart on cylinder. (See par. 20a.)

- (2) Turn breathing valve clockwise.
- (3) Raise bellows nearly to top of travel.
- (4) Close oxygen valve by turning counterclockwise.
- (5) Insert rubber stopper firmly in opening of breathing valve.
- (6) Place a 1/2-pound weight on top of bellows.
- (7) Run machine for 10 minutes.

b. Indications. (1) If tracing on chart ends higher than it began, outward leakage is indicated.

(2) If tracing on chart ends lower than it began, inward leakage is indicated. A supplemental test for inward leakage may be run with the bellows unweighted and at its lowest level. If the tracing ends lower than it began, inward leakage is again indicated.

Note: Allowance must be made for the possible warming up of the air inside of the bellows during the test. A rise of 2° or 3° will expand the bellows enough to lower the stylus a fraction of an inch.

c. Localizing the leak. (1) Remove breathing tubes and insert rubber stoppers or corks in openings of the tester. Test for leakage again. If leakage has stopped, the indication is that it was in the breathing tubes or breathing tube connections.

(2) If leakage has not stopped, it may be localized by painting all parts, particularly joints and connections, with soapy water. Bubbles indicate a leak. This test is particularly good for outward leaks. It may also be used to locate an inward leak at the oxygen inlet. The bellows must first be removed (see par. 79) in this instance.

d. Repair. (1) Replace breathing tubes or bellows if examination shows tears, cuts, or cracks.

(2) Temporary repair can sometimes be effected by cutting loose fitting ends off breathing tubes.

(3) The use of adhesive tape, and cord or wire will sometimes stop a leak temporarily.

(4) Leaks are often the result of loose joints. For instance, the cover plate on the soda lime container might not be tight. A thorough check and tightening of all joints will often stop the leak.

(5) Any leaking part should be replaced.

75. TO TEST SODA LIME (WITH PATIENT). Soda lime absorbs carbon dioxide from the exhaled gases. There comes a time eventually when the granules will not absorb carbon dioxide. When this occurs, the patient sighs frequently or progressively increases the depth of respiration which is shown by the increasing length of respiration strokes on the chart. This is not evident until the patient has been breathing for about 2 minutes. The patient notices a sensation of difficult breathing at the latter part of the test. The old soda lime should be replaced as described in paragraph 78.

76. TO TEST SODA LIME (NO PATIENT). Either of two methods of testing the soda lime may be used. One utilizes the test strips provided with the machine, the other utilizes lime water.

a. Using test strips. (1) Place two test strips in 1 inch of water (preferably distilled) in an ordinary drinking glass.

(2) Let the water set for 10 minutes shaking occasionally. The solution should have a purple tint.

(3) Remove the test strips with a glass rod and pour the solution into a shallow enamel pan.

(4) Start the motors by turning toggle switch to ON position.

(5) Turn the breathing valve clockwise.

(6) Exhale into the breathing valve until the bellows is filled. Quickly turn the breathing valve counterclockwise to retain the air in the bellows.

(7) Lower breathing valve into the test solution.

(8) Turn breathing valve clockwise so that air bubbles through the test solution.

(9) If the solution turn colorless or the purple tint fades noticeably, carbon dioxide is present and the soda lime should be replaced.

(10) If the solution retains its color, no carbon dioxide is present. However, to make sure of the efficiency of the test solution, pour it into a glass. Breathe into the test solution through a glass tube, and if the test solution is good, the color should fade noticeably or completely disappear at the end of three or four breaths.

b. Using lime water. (1) Pour a half glass of lime water into a shallow pan.

(2) Start the motors by turning toggle switch to the ON position.

(3) Turn the breathing valve clockwise.

(4) Exhale into the breathing valve until the bellows is filled. Quickly turn the breathing valve counterclockwise to retain the air in the bellows.

- (5) Lower breathing valve into the lime water.
- (6) Turn the breathing valve clockwise so that the air bubbles through the lime water.
- (7) Pour the solution back into a glass. If the solution becomes cloudy or a white precipitate forms, carbon dioxide is present and the soda lime should be replaced.

77. TO ADJUST COUNTERBALANCE TENSION. **a. Adjustment procedure.** (1) Loosen the holding screw which is at one side of the spring adjustment in front of tester base.

(2) Insert a flat piece of metal in the slot of the spring adjustment. Then turn in a counterclockwise direction until the chain is slack.

(3) Turn clockwise until the slack in the chain is taken up and continue two full turns more. Hold in this position while tightening the holding screw.

b. When correctly adjusted, the counterbalancing spring will cause the bellows top to move from its highest or lowest position toward a central position when it is released by turning the breathing valve on.

c. If the adjustment is still incorrect, try one and a half turns instead of the suggested two turns, continuing the adjustment until a satisfactory balance is obtained.

78. TO REMOVE SODA LIME CONTAINER AND REPLACE SODA LIME, 1942 AND 1943 MODELS. **a.** Remove the apparatus from its stand and lay on its front edge. (See sec. II, app. I.)

b. If there is any reason to believe that a considerable amount of moisture has accumulated inside the apparatus, proceed as follows: (1) Loosen, but do not remove the six wing nuts on the bottom of the apparatus.

(2) Loosen the cover plate and place the apparatus on a level surface to drain.

(3) When the moisture has drained from the apparatus, lay it on its front edge.

c. Remove the wing nuts and pull off the cover plate.

d. Pull the soda lime container straight out. (See fig. 10.)

e. Unlock the cover, at the opposite end of the handle, of the container by grasping the knurled edge and turning counterclockwise a short distance. Then pull up and off.

f. Remove the old soda lime.

g. Dry the container if it is moist, and free the screen of any caked soda lime by using a brush or a sharp blow against a hard surface.

h. Pour in 1½ quarts of fresh soda lime.

i. Replace cover by first lowering it so that the indentations in its edge slide into the grooves in the container. Turn clockwise to lock.

j. Slide the container back into the tester as far as it will go.

k. Replace the cover plate, being sure that the rubber gaskets and

the surfaces against which they press are free from particles that might prevent an airtight seal, and that the chain inside the bellows is not caught under the edge of the container.

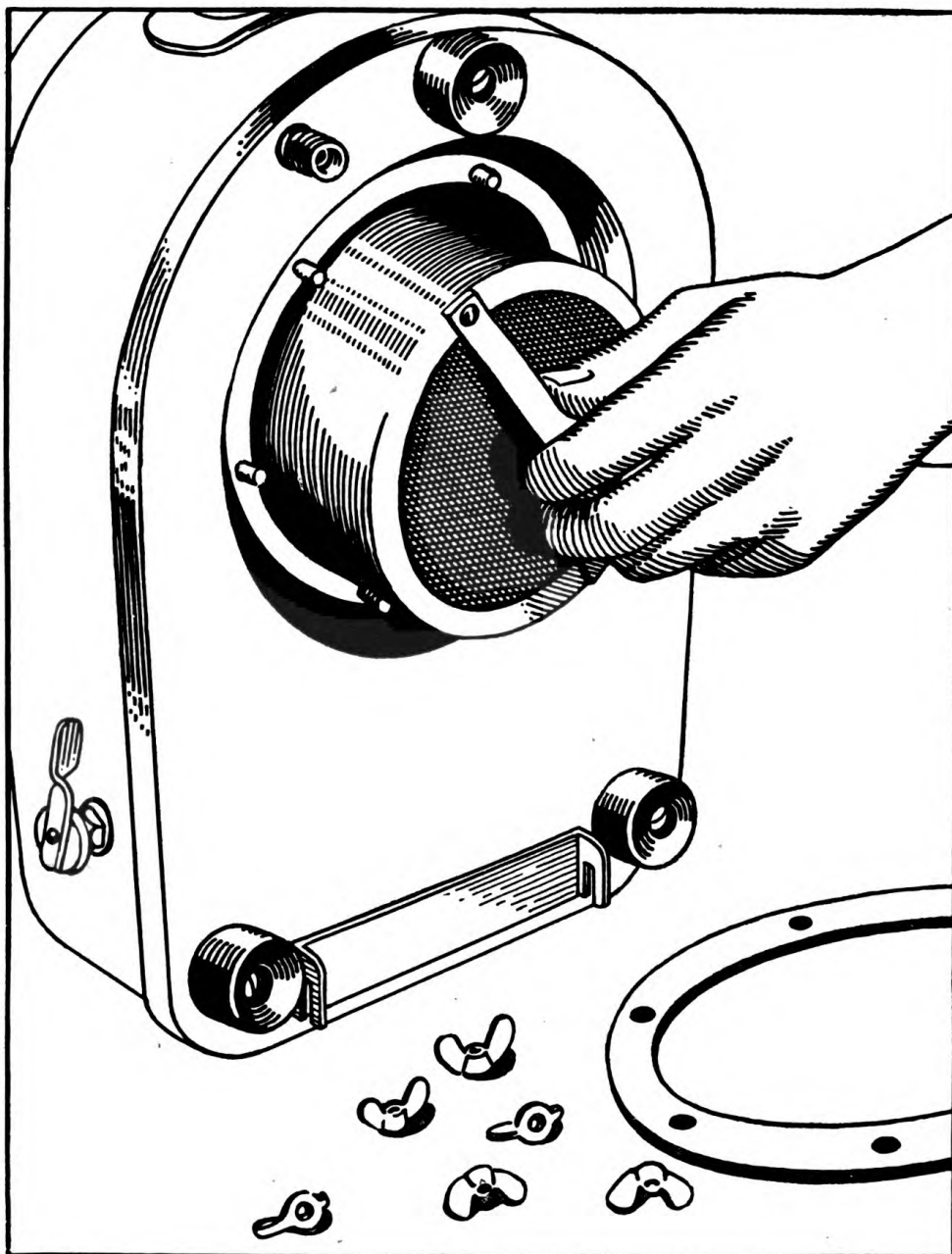


Figure 19. How to remove soda lime container.

1. Screw on the six wing nuts, turning them only enough to hold the cover plate lightly, then gradually tighten each of them in rotation so that the cover plate will be pulled up evenly against its seat.

m. Replace the apparatus on the stand. (See par. 15b.)

n. Check for leaks. (See par. 74.) If a leak is found, remove and replace container, being careful that each step is carried out carefully.

79. TO REMOVE AND REPLACE RUBBER BELLOWS. α. The metal bellows top is permanently attached to the rubber, forming a unit which is easily removed from the apparatus base and replaced.

b. Disengage beaded chain from bellows top by unscrewing the anchor and slipping chain out of groove.

c. Pry out adjustable clasp and remove band.

d. Disconnect beaded chain from inside of bellows by unscrewing the anchor and slipping the chain out of groove.

e. Lift off bellows.

f. Clean surface of metal to which the bellows is to be clamped by scraping with a knife or washing with soap and water if necessary.

g. Remove any particles which have adhered to the bellows.

h. Attach the beaded chain inside of the bellows.

i. Cover metal with mucilage such as MD item No. 7587000.

j. Moisten the clamping band and outside surface of the rubber with water.

k. Slip bellows into place over metal rim and clamp in place.

80. TO REMOVE AND REPLACE THERMOMETER ASSEMBLY. α. Unscrew the thermometer assembly counterclockwise from base of apparatus.

b. To replace, screw the thermometer assembly clockwise into base of apparatus. Be sure that the connection is tight to prevent leakage.

81. TO REMOVE AND REPLACE PENHOLDER ASSEMBLY. α. Remove the screws from the top of the guide rods permitting the rods to drop.

b. Remove the penholder assembly by sliding it up and over the ends of the rods.

c. Disengage assembly from the chain by pulling back on chain lock clip and slipping chain out of the slot.

d. To replace, slide the repaired or new penholder assembly over the ends of the rods and down.

e. Slide the guide rods up to their original position and fasten them in place with screws.

f. Adjust the height of the penholder assembly. (See par. 90.)

82. TO REMOVE AND REPLACE CHAIN LOCK CLIP. α. Remove the penholder assembly. (See par. 81.)

b. Slide the chain lock clip toward the slotted end of the holder and remove.

c. To replace, reverse the above steps.

83. TO REMOVE AND REPLACE PEN. Slip pen out of sheath or holder and replace with new pen.

84. TO REMOVE AND REPLACE PRESSURE GAUGE AND MEASURING CHAMBER UNIT. **a.** To remove, see paragraph 95.

b. To replace, see paragraph 15b(4).

85. TO REMOVE AND REPLACE SODA LIME CONTAINER GASKET.

a. Remove soda lime cover plate and container. (See par. 78.)

b. Remove rubber gasket.

c. Clean metal surface where the gasket fits by scraping with a knife.

d. Remove any particles which have adhered to the gasket.

e. Cover with a thin layer of mucilage such as MD item number 7587000.

f. Replace gasket.

g. Replace soda lime container and cover plate.

86. TO REMOVE AND REPLACE PILOT BULB. **a.** Remove the bottom plate of the apparatus by removing three holding screws from the rim.

b. Remove the pilot bulb from its socket.

c. Replace with new bulb.

d. Replace bottom plate of apparatus and hold in place with three holding screws.

87. TO REPLACE AND ADJUST STYLUS POINT. **a.** Remove stylus by pulling straight out of socket.

b. If stylus is loose, remove it as in a above and with the fingers, push holding springs together until the stylus is a firm push fit in its holder.

c. Insert stylus by pushing straight into its socket, so that it fits firmly.

d. Replace stylus by removing old one as in a above and inserting new one as in c above.

88. TO STERILIZE MOUTH PIECE, BREATHER VALVE, AND RUBBER BREATHING TUBES. All these articles are of rubber or partly of rubber. Sterilize the same as other rubber goods.

89. CLEANING. **a.** The unit should be kept clean both inside and out. Wipe off the outside and inside with a damp cloth and then a dry cloth.

b. Small particles of soda lime which have adhered to the metal parts should be removed by brushing with a stiff brush, taking care not to damage any parts.

90. TO ADJUST HEIGHT OF PEN HOLDER ASSEMBLY. **a.** Pull back on chain lock clip.

b. Slip chain out of slot.

c. Move pen assembly up or down on guide rods until it is at the

desired height. The assembly should be near the top of the chart cylinder when the bellows is deflated.

d. Slip chain in slot.

e. Push back chain lock clip so that the chain is secured.

91. TO ADJUST STYLUS PRESSURE. α. Loosen the screw "1" (fig. 11) at the end of the hinge.

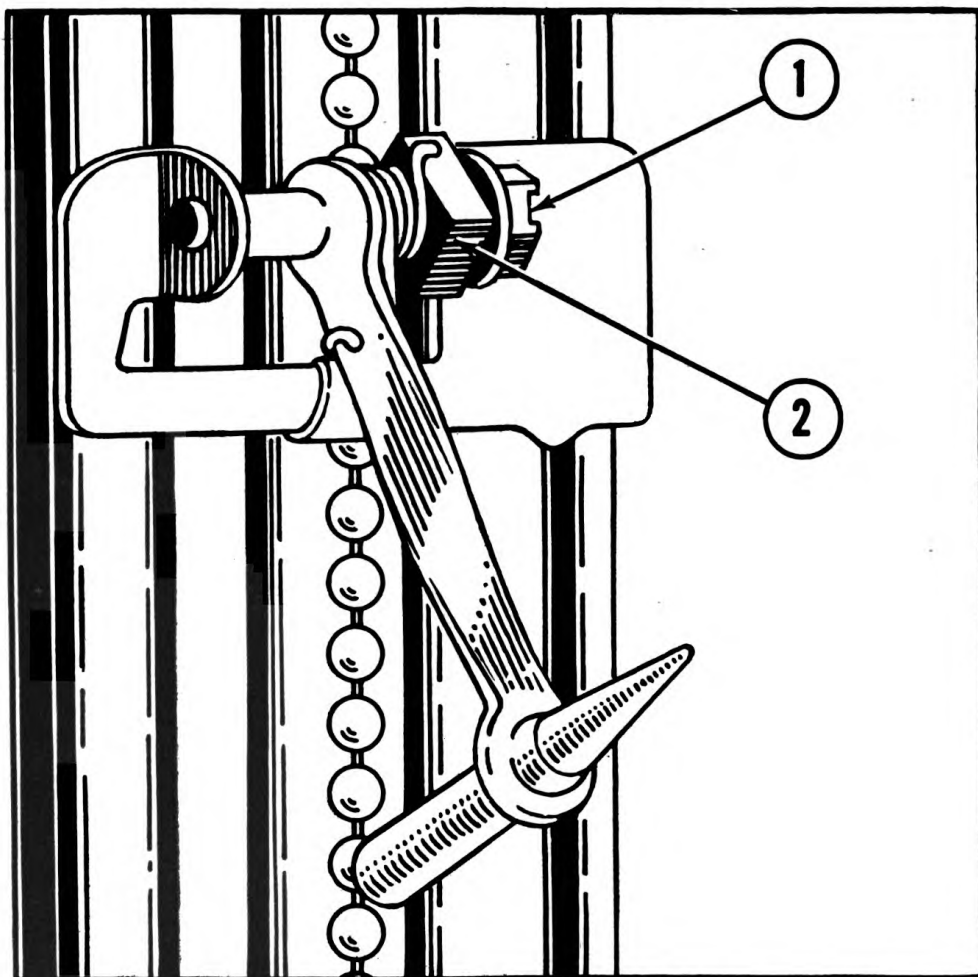


Figure 11. Adjusting stylus pressure.

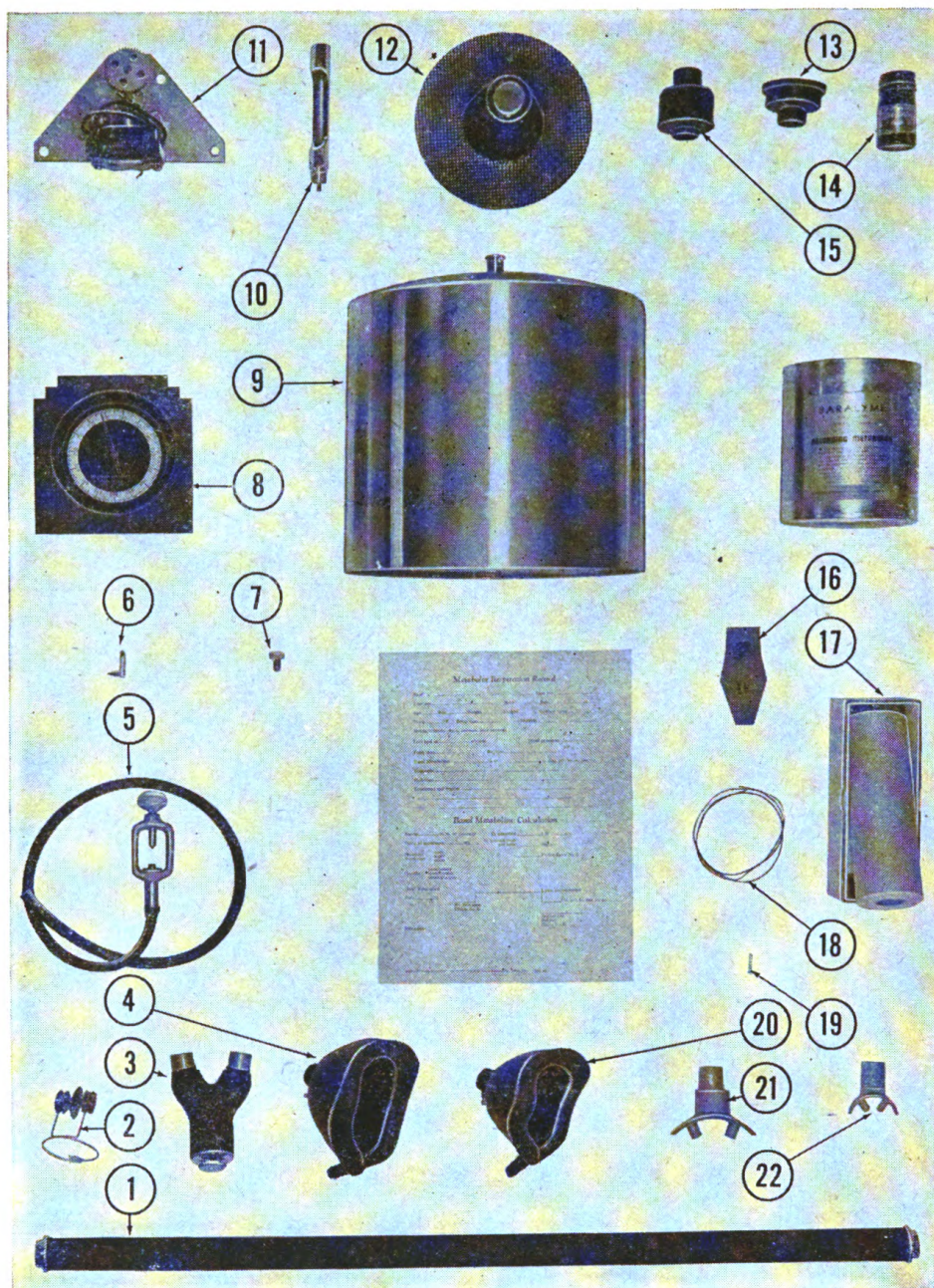
b. Turn the square nut "2" (fig. 11) to increase or decrease the strength of the spring.

c. Tighten screw "1" (fig. 11) to hold the nut in its new position.

d. The tension on the spring should be just enough to make the stylus press lightly on the chart. Too much pressure makes the stylus dig into the chart's surface and adds unnecessary friction.

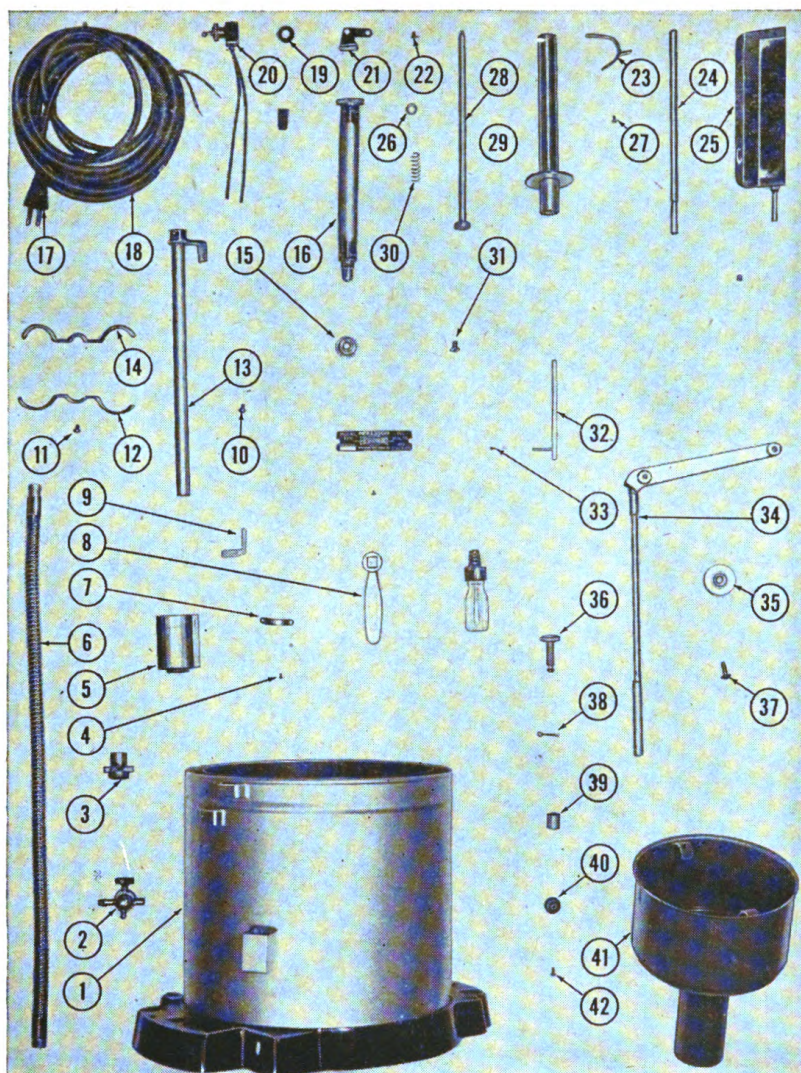
92. TO REPLACE OXYGEN VALVE. α. Turn valve counterclockwise until the valve knob is removed.

- b.** Remove locknut.
- c.** Pull out plunger, gasket, and spring.
- d.** Replace with new plunger, gasket, and spring. These three items will be in one assembly.
- e.** Replace locknut.
- f.** Replace valve knob.



Med. Dept. No.	Nomenclature	Med. Dept. No.	Nomenclature
1. 4R05376	Tube, breathing, rubber	12. 4R05442	Baffle, soda lime
2. 4R03778	Clamp, nose	13. 4R05380	Base, inhaling
3. 4R05390	Inhaler, Y-Piece, complete	14. 4R05368	Ink, oiled, red
4. 4R05358	Mask, face, portable, large	15. 4R05382	Base, exhaling
5. SR00058	Tubing, rubber, $\frac{3}{8}$ in. O.D., $\frac{3}{16}$ in. I.D.	16. 4R05364	Valve, flutter, rubber
6. 4R05378	Pen, chart roll	17. 4021008	Basal metabolism chart, McKesson, 100
7. 4R05352	Screw, thumb, crane locking	18. 4R05422	Cord, counterweight
8. 4R03798	Barometer	19. 4R05424	Anchor, counterweight cord, metal
9. 4R05388	Bell, float, oxygen	20. 4R05360	Mask, face, portable, small
10. 4R05372	Thermometer, complete	21. 4R05448	Mouthpiece, large
11. 4R05386	Motor, synchronous, 110 v., a.c., 60 cy.	22. 4R05450	Mouthpiece, small

Figure 12. Parts for Basal Metabolism Apparatus, McKesson Appliance Company.



Med. Dept.
No.

Nomenclature

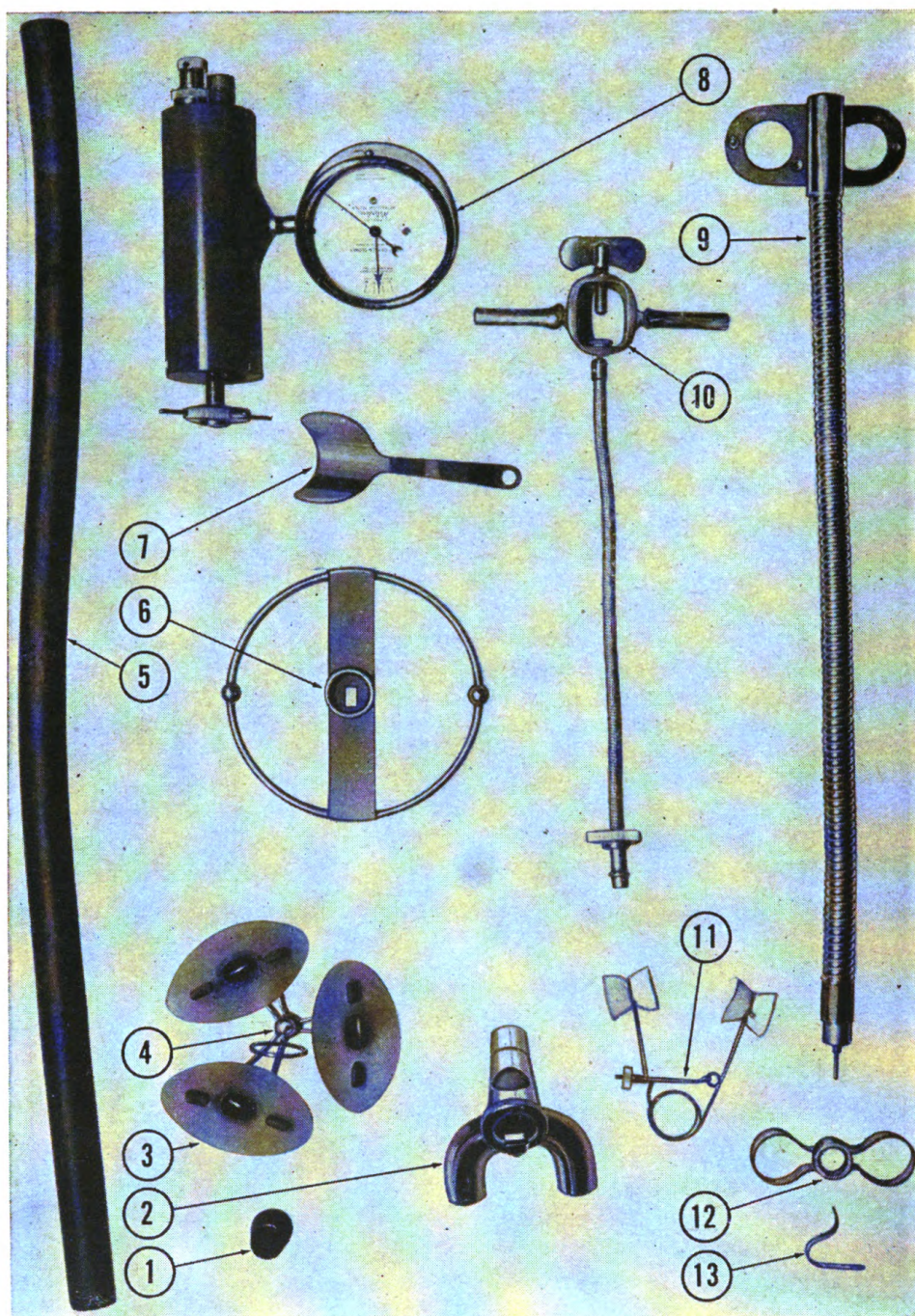
1. 4R05392 Container, water, complete
2. 4R05452 Stopcock
3. 4R05432 Adapter, breathing tube
4. SR00270 Screw, 2-54 x 1/4 in., b.h.m.
5. 4R05418 Counterweight
6. 4R05434 Support, flexible
7. 4R05428 Holder, spring, pen carrier
8. 4R05362 Wrench
9. 4R05420 Hook, counterweight
10. 4R05456 Screw, crane bracket
11. SR00140 Screw, 10-32 x 1/4 in., r.h.m.
12. 4R05438 Clamp, breathing tube, threaded
13. 4R05412 Tube, lower crane
14. 4R05436 Clamp, breathing tube, unthreaded
15. 4R05446 Gear, feed roll
16. 4R05394 Feed roll
17. SR00026 Plug, male, small, two-prong
18. SR00073 Cord, neoprene, No. 16, two conductor
19. 4R05454 Grommet, rubber
20. 4R05366 Switch, toggle, 3 amp., 250 v.
21. 4R05404 Bracket, feed roll

Med. Dept.
No.

Nomenclature

22. 4R05458 Screw, feed roll bracket
23. 4R05408 Guide, paper
24. 4R05406 Support, paper guide
25. 4R05444 Plate, guide
26. 4R05398 Collar, clutch spring
27. SR00268 Screw, 3-48 x 1/4 in., r.h.m.
28. 4R05396 Shaft, feed roll
29. 4R05410 Holder, tube
30. 4R05402 Spring, clutch
31. SR00271 Screw, 10-24 x 1/4 in., fl.h.m.
32. 4R05426 Carrier, pen
33. 4R05356 Screw, round head, pen
34. 4R05414 Tube, upper crane
35. 4R05416 Pulley
36. 4R05354 Screw, thumb, leveling
37. SR00224 Screw, 1/4 in.-20 x 1/2 in., r.h.m.
38. SR00147 Pin, cotter, 1/16-in. dia. x 3/4 in.
39. 4R05430 Receptacle, leveling screw
40. 4R05370 Rest, base, rubber
41. 4R05440 Container, soda lime
42. SR00111 Screw, 8-32 x 1/4 in., r.h.m.

Figure 13. Parts for Basal Metabolism Apparatus, McKesson Appliance Company.



Med. Dept. No.	Nomenclature
1. 4R03794	Stopper, rubber, No. 3
2. 4R03702	Valve, breathing, complete
3. 4R03802	Mouthpiece
4. 4R05470	Holder, mouthpiece
5. 4R03704	Tube, breathing
6. 4R03758	Handwheel, oxygen
7. 4R03806	Tester, leak

Med. Dept. No.	Nomenclature
8. 4R03756	Gage, complete
9. 4R05462	Support, flexible, breathing tube
10. 4R03750	Yoke, oxygen, complete
11. 4R03778	Noseclip, complete
12. 4R05464	Clamp, breathing tube
13. 4R05466	Holder, noseclip

Figure 14. Parts for Basal Metabolism Apparatus, The Sanborn Company.

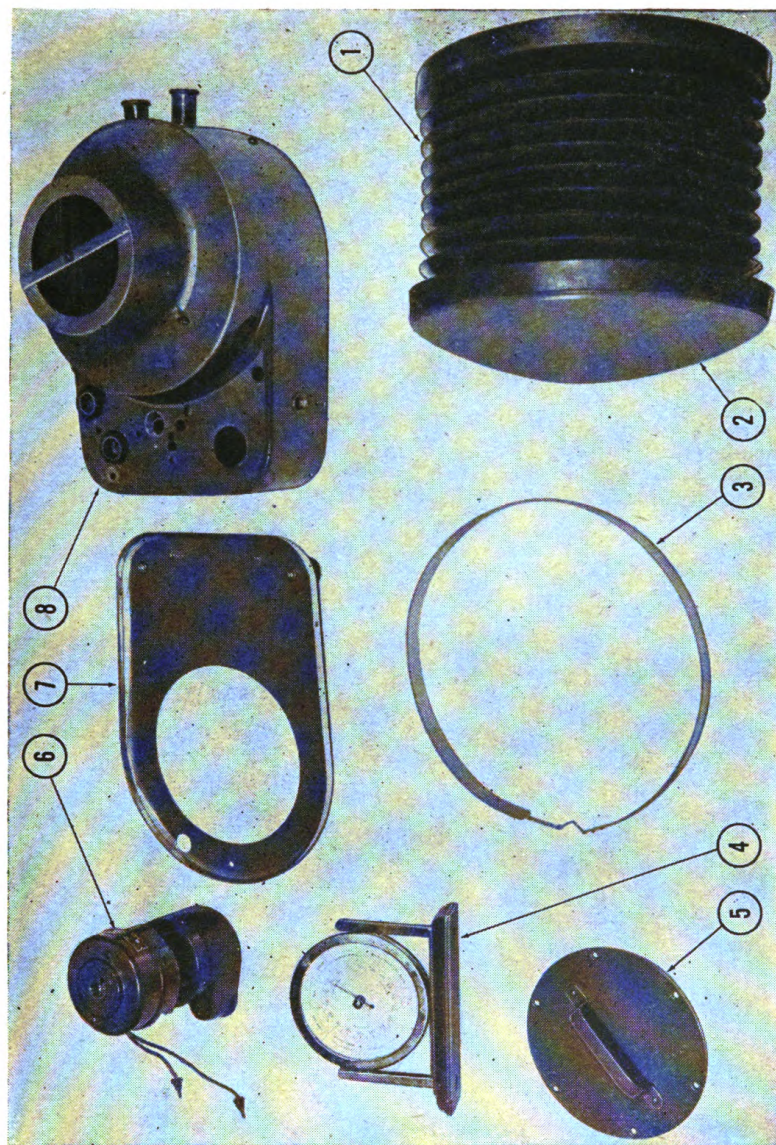


Figure 15. Parts for Basal Metabolism Apparatus, The Sanborn Company.

Med. Dept. No.	Nomenclature
1. 4R03734	Bellows
2. 4R03710	Head, bellows
3. 4R03732	Band, bellows
4. 4R03798	Barometer
5. 4R03760	Disc, soda lime, cover
6. 4R03720	Blower, motor, complete
7. 4R05500	Plate, bottom
8. 4R05498	Base, main

Med. Dept. No.	Nomenclature
1. 4R03800	Cover, protective
2. 4R05472	Cylinder, chart
3. 4021023	Basal metabolism chart, Sanborn 8-MC, 100
4. 4R05502	Rest, rubber
5. 4R03766	Container, soda lime, inner
6. SR00073	Cord, neoprene, No. 16, two conductor
7. SR00026	Plug, male, small, two prong

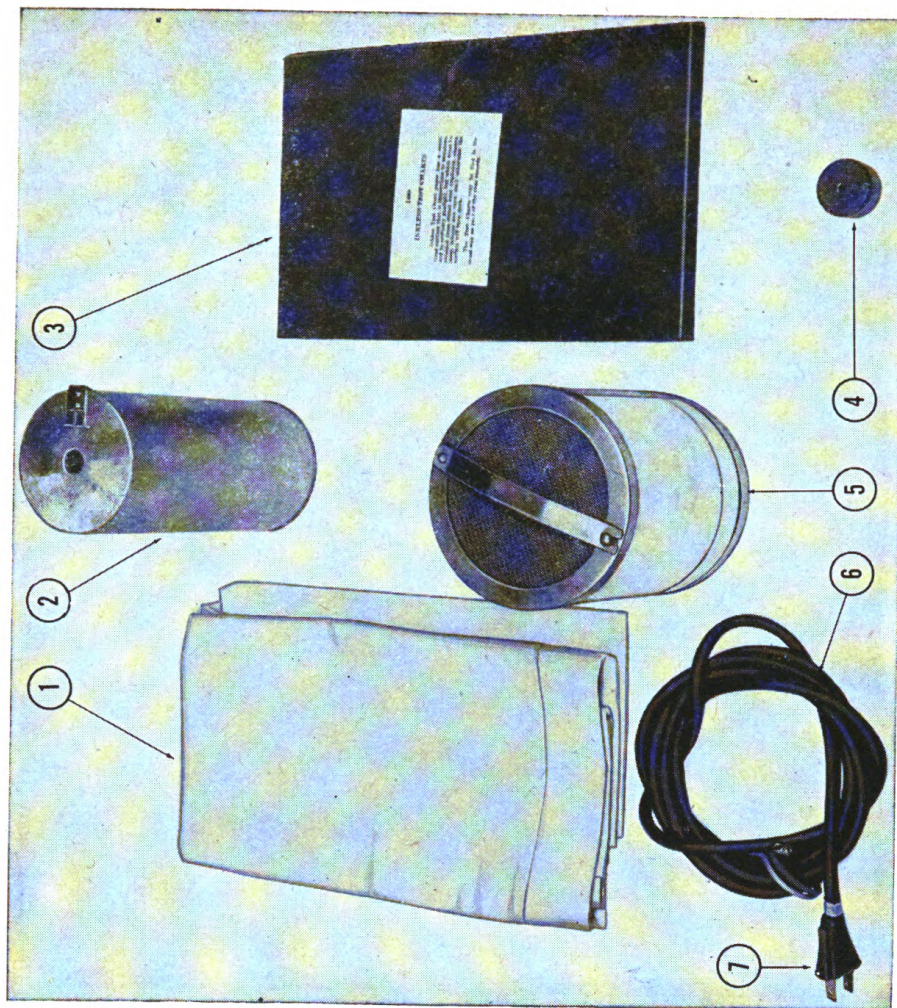
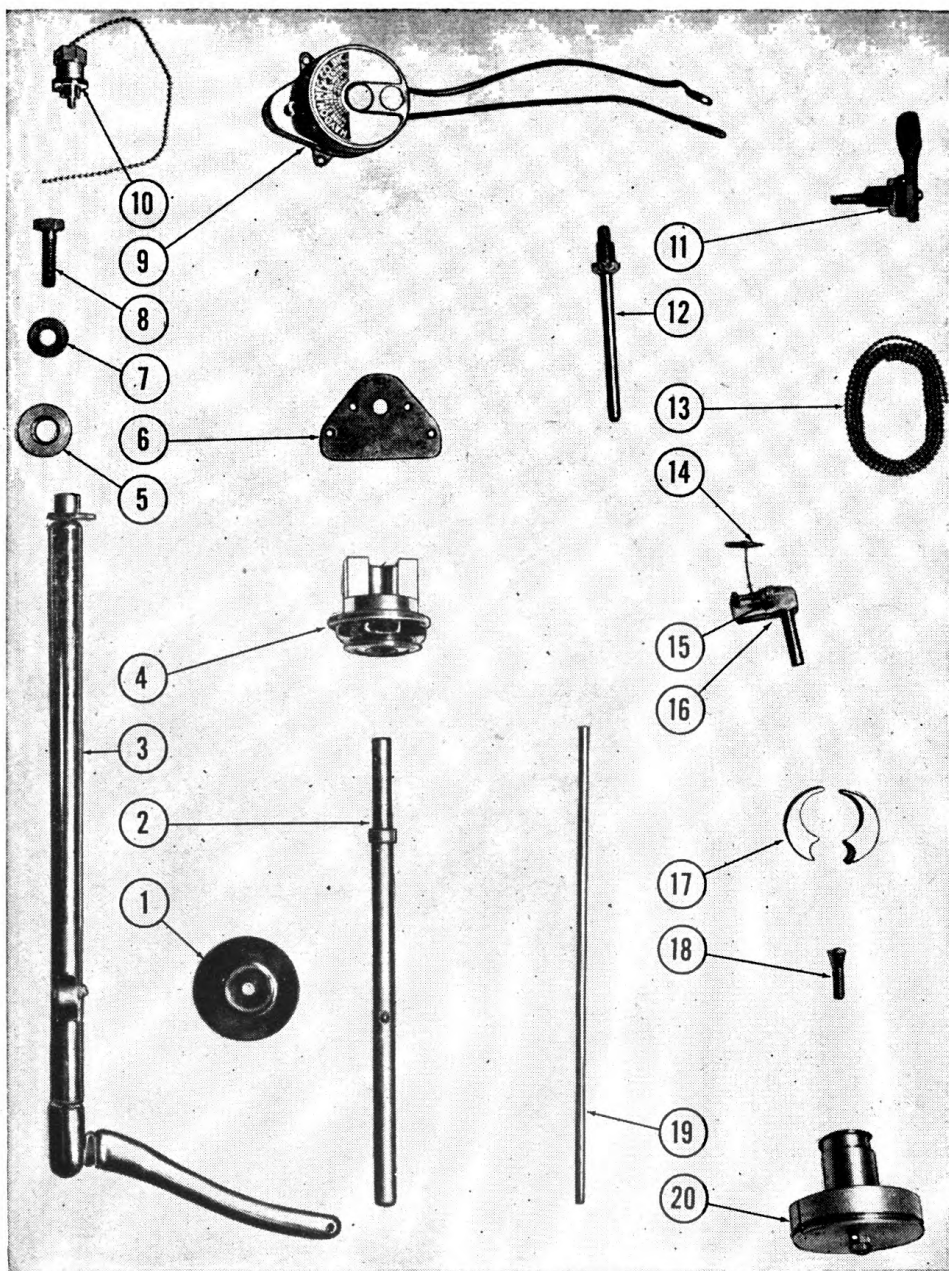
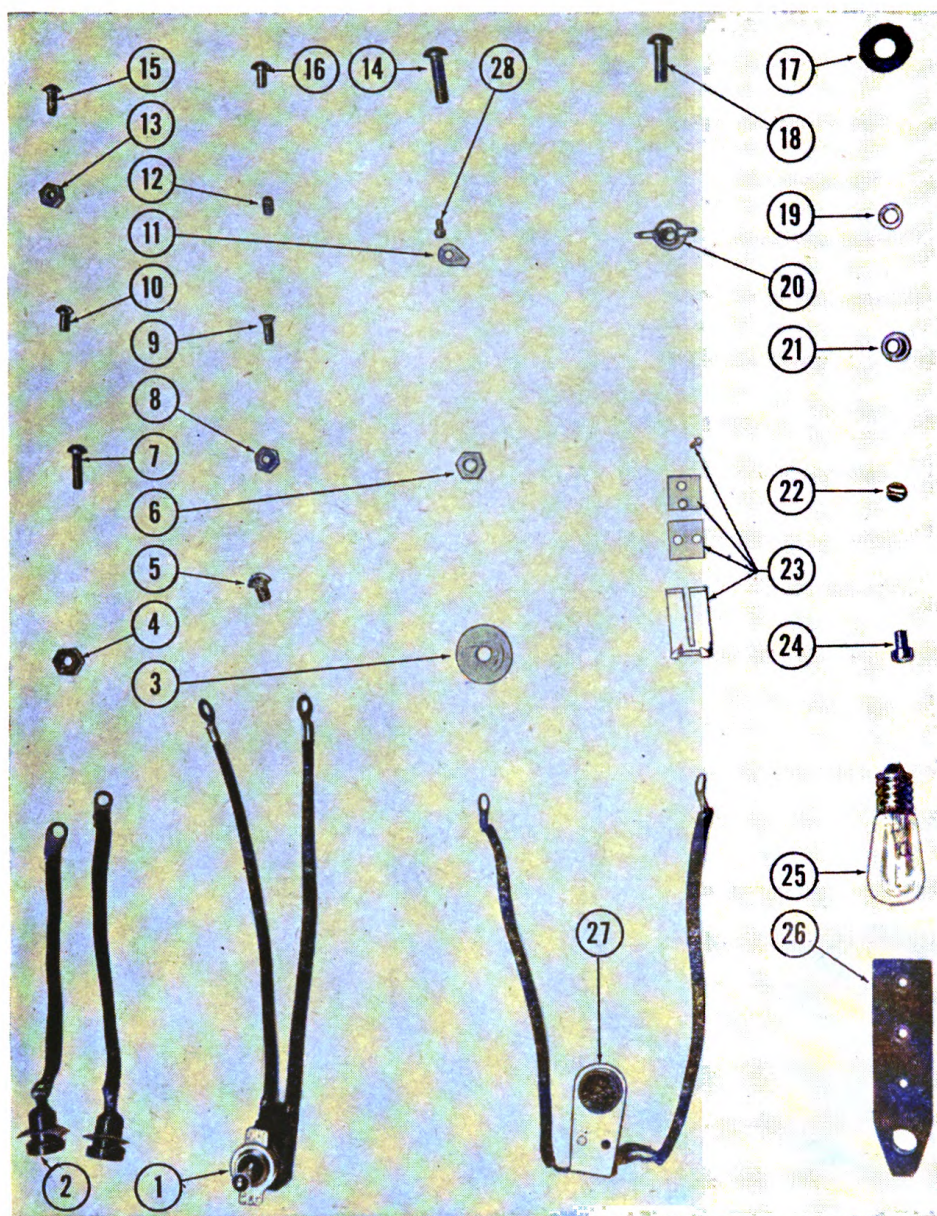


Figure 16. Parts for Basal Metabolism Apparatus, The Sanborn Company.



Med. Dept. No.	Nomenclature	Med. Dept. No.	Nomenclature
1. 4R03730	Pulley	11. 4R03706	Valve, oxygen
2. 4R05486	Spindle, chart roll	12. 4R03714	Thermometer and bushing, complete
3. 4R05490	Upright, tube	13. 4R03784	Chain, counterbalance, 27 $\frac{7}{8}$ in.
4. 4R05488	Housing, spindle, complete	14. 4R03728	Stylus
5. 4R05492	Spacer, upright	15. 4R03726	Clip, lock, chain
6. 4R05496	Plate, mounting	16. 4R03724	Slide, stylus, complete
7. SR00404	Washer, screw size $\frac{5}{16}$	17. 4R05476	Collar, locking, split
8. SR00403	Screw, $\frac{5}{16}$ in.-18 x 1 in., hex head machine	18. 4R05478	Screw, locking collar
9. 4R03744	Motor, clock, 110 v., 60 cy., a.c.	19. 4R05474	Rod, guide, stylus slide
10. 4R03708	Valve, bellows, relief	20. 4R03736	Balance, spring, complete

Figure 17. Parts for Basal Metabolism Apparatus, The Sanborn Company.



Med. Dept. No.	Nomenclature	Med. Dept. No.	Nomenclature
1. SR00048	Switch, toggle, complete	15. SR00408	Screw, 3-48 x $\frac{3}{16}$ in., r.h.m.
2. 4R05480	Jack, pin, complete	16. SR00104	Screw, 6-32 x $\frac{3}{16}$ in., r.h.m.
3. 4R05468	Washer, clamp	17. 4R05484	Grommet, rubber
4. SR00273	Nut, 10-32, hex., brass	18. SR00409	Screw, 5-40 x $\frac{5}{16}$ in., r.h.m., brass
5. SR00140	Screw, 10-32 x $\frac{1}{4}$ in., r.h.m.	19. SR00297	Washer, screw size 10
6. SR00330	Nut, 10-32 hex.	20. 4R03762	Nut, wing
7. SR00300	Screw, 10-32 x $\frac{1}{4}$ in., r.h.m.	21. 4R05494	Bearing, pulley
8. SR00273	Nut, 10-32, hex., brass	22. 4R05460	Anchor, chain
9. SR00405	Screw, 5-40 x $\frac{1}{4}$ in., fl.h.m.	23. 4R03748	Accessories, chart, cylinder
10. SR00040	Screw, 6-32 x $\frac{1}{4}$ in., r.h.m.	24. SR00407	Screw, 10-32 x $\frac{1}{4}$ in., fill. h.m.
11. 4R03738	Clip, chain	25. 4R03776	Bulb, pilot
12. SR00406	Set screw, 6-32 x $\frac{1}{4}$ in., Allen head, cup pt.	26. 4R05482	Strip, terminal
13. SR00347	Nut, 6-32, hex., brass	27. 4R03774	Lamp, pilot, complete
14. SR00411	Screw, 6-32 x $\frac{1}{2}$ in., r.h.m., brass	28. SR00408	Screw, 3-48 x $\frac{3}{16}$ in., r.h.m.

Figure 18. Parts for Basal Metabolism Apparatus, The Sanborn Company.

APPENDIX I

SHIPMENT AND STORAGE

Section I. McKESSON

- 1. DISASSEMBLING THE APPARATUS.** **a.** Remove water from apparatus. (See par. 7d.)
 - b.** Remove soda lime from apparatus. (See par. 10b.)
 - c.** Allow to dry thoroughly.
 - d.** Disconnect Y-piece inhaler.
 - e.** Loosen crane locking thumbscrew and allow the crane to drop to its lowest position.
 - f.** Disconnect counterweight cord and anchor from the bell and tie the cord to the top of the crane.
- 2. REPACKING THE APPARATUS.** **a.** Bend the flexible breathing tube support with breathing tubes over the top of the bell.
 - b.** Place in packing carton.
 - c.** Add packing material to prevent injury to the metabolor and hold it in place.
 - d.** Seal the carton with gummed tape.
 - e.** The stand should be packed in a separate carton.

Section II. SANBORN

- 3. DISASSEMBLING THE APPARATUS.** **a. If the pressure gauge and gas measuring chamber are used.** (1) Disconnect the pressure chamber from the base of the apparatus.
 - (2) Disconnect the oxygen tube from the bottom of the pressure chamber.
 - (3) Grasp the base and tilt the tester until the oxygen inlet in the base is clear of the hole in the stand.
 - (4) Slide the hooks on the base of the apparatus off the cross rod on the stand. This removes the tester from the stand.
 - (5) Lift the oxygen cylinder out of the stand and remove the hand-wheel.

(6) Loosen thumbscrew and remove the tank yoke.

b. If the direct connection of the flexible oxygen tube to the apparatus is used. (1) Disconnect the oxygen cylinder from the bottom of the apparatus.

(2) Proceed as in steps a(3) to (6) above.

4. PACKING THE APPARATUS. a. To pack the apparatus. (1) Place chart on cylinder to prevent scratching.

(2) Press bellows to bottom.

(3) Turn breathing valve off.

(4) Fasten flexible breathing tube support under hook.

(5) Place tester on the packing base board.

(6) Fasten by ribbon flat across tester base near chart and motor blower and tie firmly.

(7) Fasten bellows in place by ribbon across its top.

(8) Fasten other end by ribbon across flexible support bracket and tubing.

(9) Coil electric cord, hold with elastic band, tuck underneath breathing tube connections.

(10) Place base board containing apparatus in carton.

(11) Slide inner shell all the way to base board.

(12) Fold in end pieces, then side pieces.

(13) Place handle-piece on top.

(14) Remove gummed tapes and labels which are provided for re-packing.

(15) Fold over short end pieces, then two side pieces. In fastening, stick gummed tapes and labels over originals.

b. To pack the stand. (1) Put frame in bottom of carton.

(2) Place barometer, pressure gauge and measuring chamber (if received) into center space. If stand is to be shipped without an oxygen tank, put yoke and handwheel in another space. Put frame cover in the middle.

(3) If oxygen tank is to be shipped, leave it in the stand with yoke and handwheel in place.

(4) Place stand in carton with accessory pocket parallel to one of the sides.

(5) Place cover with "A" label so that attached pressure pad is directly over the handwheel.

(6) Place hand-piece on top.

(7) Remove gummed tapes and labels which are provided for packing.

(8) Fold over four short end pieces, then side pieces. In fastening, stick gummed tapes and labels over originals.

APPENDIX II

USE OF CAPILLARY PEN, SANBORN

1. USE OF CAPILLARY PEN (SANBORN). **a.** The apparatus when received will be supplied with waxed or inkless charts. The stylus is for use with these charts. However unwaxed charts may be obtained and in order to use these charts the capillary pen is supplied. It is stored at the top of the pen assembly guide rods.

b. To install capillary pen. (1) Remove stylus point by pulling it straight out of its socket.

(2) Replace with capillary pen by pushing pen firmly into socket.

c. To fill ink well with ink. (1) Remove inner shell.

(2) Drop fountain pen ink into the ink well until it is two-thirds full.

(3) Replace the inner shell and twist it a little.

(4) Press down with ball of finger on the top to force ink through the writing point.

d. Care of capillary pen. (1) The hole through the writing point is very small. Do not allow ink to dry in it.

(2) After each day's use, rinse pen parts in hot water.

(3) A fine wire, about 0.01" diameter, may be used to clear the hole if it becomes clogged.

APPENDIX III

LIST OF ALL SERVICE PARTS

Section I. McKESSON

Fig. No.	Medical Dept. No.	Nomenclature	Unit	Quantity
MEDICAL DEPARTMENT ITEMS				
	1425000	Sodium Calcium Hydrate: (Sodalime) special for basal metabolism, Mesh 4-8 (No. 4) coarse	qt. ...	Distribution as required
COMMON PARTS				
*13	SR00026	Plug, male, small, two prong	ea. ...	"
*12	SR00058	Tubing, rubber, $\frac{3}{8}$ in. O.D., $\frac{3}{16}$ in. I.D. For oxygen tank	ft.	"
*13	SR00073	Cord, neoprene, No. 16, two conductor	ft.	"
13	SR00111	Screw, 8-32 x $\frac{1}{4}$ in., r.h.m., 144 to pkg. ...	pkg. ..	"
13	SR00140	Screw, 10-32 x $\frac{1}{4}$ in., r.h.m., 144 to pkg. ..	pkg. ..	"
13	SR00147	Pin, cotter, $\frac{1}{16}$ in. dia. x $\frac{3}{4}$ in., 144 to pkg.	pkg. ..	"
13	SR00224	Screw, $\frac{1}{4}$ in.-20 x $\frac{1}{2}$ in., r.h.m., 144 to pkg.	pkg. ..	"
	SR00236	Screw, 6-32 x $\frac{1}{4}$ in., b.h.m., 144 to pkg. ...	pkg. ..	"
	SR00267	Washer, screw size $\frac{1}{4}$, fiber, for tank yoke..	lb. ...	"
13	SR00268	Screw, 3-48 x $\frac{1}{4}$ in., r.h.m., 144 to pkg. ...	pkg. ..	"
13	SR00270	Screw, 2-54 x $\frac{1}{8}$ in., b.h.m., 144 to pkg. ...	pkg. ..	"
13	SR00271	Screw, 10-24 x $\frac{1}{4}$ in., fl.h.m., 144 to pkg. ..	pkg. ..	"
UNCOMMON PARTS				
*12	4R03778	Clamp, nose	ea. ...	1
*12	4R03798	Barometer	ea. ...	1
*12	4R05352	Screw, thumb, crane locking, $\frac{1}{4}$ in.-24 x $\frac{7}{16}$ in.	ea. ...	1
13	4R05354	Screw, thumb, leveling	ea. ...	2
13	4R05356	Screw, round head, pen	ea. ...	1
*12	4R05358	Mask, face, portable, large	ea. ...	1
*12	4R05360	Mask, face, portable, small	ea. ...	1
13	4R05362	Wrench, for tank and yoke	ea. ...	1
*12	4R05364	Valve, flutter, rubber	ea. ...	2
*13	4R05366	Switch, toggle, 3 amp., 250 v.	ea. ...	1
*12	4R05368	Ink, oiled, red, $\frac{1}{2}$ oz. bottle	ea. ...	1
13	4R05370	Rest, base, rubber	ea. ...	3
*12	4R05372	Thermometer, complete, with metal case ..	ea. ...	1
	4R05374	Stand, metal, complete, with drawer and tank yoke	ea. ...	1
*12	4R05376	Tube, breathing, rubber, length 28 in.	ea. ...	2
*12	4R05378	Pen, chart roll	ea. ...	1

Fig. No.	Medical Dept. No.	Nomenclature	Unit	Quantity
*12	4R05380	Base, inhaling, for flutter valve	ea. ...	1
*12	4R05382	Base, exhaling, for flutter valve	ea. ...	1
12	4R05384	Connection, tubing, for tank yoke	ea. ...	1
	4R05385	Motor, synchronous, 110 v., a.c., 25 cy.	ea. ...	1
*12	4R05386	Motor, synchronous, 110 v., a.c., 60 cy.	ea. ...	1
	4R05387	Motor, synchronous, 220 v., a.c., 60 cy.	ea. ...	1
12	4R05388	Bell, float, oxygen	ea. ...	1
*12	4R05390	Inhaler, Y-piece, complete	ea. ...	1
13	4R05392	Container, water, complete, with base	ea. ...	1
13	4R05394	Feed roll	ea. ...	1
13	4R05396	Shaft, feed roll	ea. ...	1
13	4R05398	Collar, clutch spring	ea. ...	1
	4R05400	Pin, retaining, for clutch spring collar	ea. ...	1
13	4R05402	Spring, clutch	ea. ...	1
13	4R05404	Bracket, feed roll	ea. ...	1
13	4R05406	Support, paper guide	ea. ...	1
13	4R05408	Guide, paper	ea. ...	2
13	4R05410	Holder, tube, for chart roll	ea. ...	1
13	4R05412	Tube, lower crane	ea. ...	1
13	4R05414	Tube, upper crane	ea. ...	1
13	4R05416	Pulley, complete with bearings	ea. ...	2
13	4R05418	Counterweight	ea. ...	1
13	4R05420	Hook, counterweight	ea. ...	1
*12	4R05422	Cord, counterweight, length 21 in.	ea. ...	1
*12	4R05424	Anchor, counterweight cord, metal	ea. ...	1
*13	4R05426	Carrier, pen	ea. ...	1
*13	4R05428	Holder, spring, pen carrier	ea. ...	1
13	4R05430	Receptacle, leveling screw	ea. ...	2
13	4R05432	Adapter, breathing tube	ea. ...	2
13	4R05434	Support, flexible, for breathing tubes	ea. ...	1
13	4R05436	Clamp, breathing tube, unthreaded	ea. ...	1
13	4R05438	Clamp, breathing tube, threaded	ea. ...	1
13	4R05440	Container, soda lime	ea. ...	1
12	4R05442	Baffle, soda lime, for soda lime container 4R05440	ea. ...	1
13	4R05444	Plate, guide, for chart roll	ea. ...	1
13	4R05446	Gear, feed roll	ea. ...	1
*12	4R05448	Mouth piece, large	ea. ...	1
*12	4R05450	Mouth piece, small	ea. ...	1
*13	4R05452	Stopcock, for water and oxygen	ea. ...	2
13	4R05454	Grommet, rubber, for counterweight cord..	ea. ...	1
13	4R05456	Screw, crane bracket	ea. ...	2
13	4R05458	Screw, feed roll bracket	ea. ...	2
*	9R02912	Harness, head	ea. ...	1

* To be requisitioned from Supply Depot. No asterisk indicates that the item is not stocked as a spare part but can be obtained by special requisition.

Section II. SANBORN

Fig. No.	Medical Dept. No.	Nomenclature	Unit	Quantity
		MEDICAL DEPARTMENT ITEMS		
	1425000	Sodium calcium hydrate: (Sodalime) special for basal metabolism. Mesh 4-8 (No. 4) coarse	qt. ...	Distribution as required
		COMMON PARTS		
*16	SR00026	Plug, male, small, two-prong	ea. ...	"
18	SR00040	Screw, 6-32 x 1/4 in., r.h.m., 144 to pkg. ...	pkg. ..	"
*18	SR00048	Switch, toggle, complete	ea. ...	"
*16	SR00073	Cord, neoprene, No 16, two conductor	ft.	"
18	SR00104	Screw, 6-32 x 3/16 in., r.h.m., 144 to pkg. ...	pkg. ..	"
	SR00139	Screw, 10-32 x 3/16 in., r.h.m., 144 to pkg. ...	pkg. ..	"
18	SR00140	Screw, 10-32 x 1/4 in., r.h.m., 144 to pkg. ...	pkg. ..	"
18	SR00273	Nut, 10-32, hex, brass, 144 to pkg.	pkg. ..	"
18	SR00297	Washer, screw size 10	lb.	"
18	SR00300	Screw, 10-32 x 1/2 in., r.h.m., 144 to pkg. ...	pkg. ..	"
18	SR00330	Nut, 10-32, hex, 144 to pkg.	pkg. ..	"
18	SR00347	Nut, 6 x 32, hex, brass, 144 to pkg.	pkg. ..	"
17	SR00403	Screw, 5/16 in.-18 x 1 in., hex, head machine, 144 to pkg.	pkg. ..	"
17	SR00404	Washer, screw size 5/16	lb. ...	"
18	SR00405	Screw, 5-40 x 1/4 in., fl.h.m., 144 to pkg. ...	pkg. ..	"
18	SR00406	Set screw, 6-32 x 1/4 in., Allen head, cup pt., 144 to pkg.	pkg. ..	"
18	SR00407	Screw, 10-32 x 1/4 in., fl.h.m., 144 to pkg. ...	pkg. ..	"
18	SR00408	Screw, 3-48 x 3/16 in., r.h.m., 144 to pkg. ...	pkg. ..	"
18	SR00409	Screw, 5-40 x 5/16 in., r.h.m., brass, 144 to pkg.	pkg. ..	"
18	SR00411	Screw, 6-32 x 1/2 in., r.h.m., brass, 144 to pkg.	pkg. ..	"
		UNCOMMON PARTS		
*14	4R03702	Valve, breathing, complete, assembly	ea. ...	1
*14	4R03704	Tube, breathing	ea. ...	2
*17	4R03706	Valve, oxygen	ea. ...	1
*17	4R03708	Valve, bellows, relief	ea. ...	1
*15	4R03710	Head, bellows	ea. ...	1
*	4R03712	Plunger, bellows, relief valve, complete ...	ea. ...	1
*17	4R03714	Thermometer and bushing, complete	ea. ...	1
*	4R03716	Holder, pen, complete, assembly	ea. ...	1
*	4R03718	Pen, capillary, complete	ea. ...	1
*15	4R03720	Blower, motor, complete	ea. ...	1
	4R03722	Assembly, upright, complete, accessories ..	ea. ...	1
*17	4R03724	Slide, stylus, complete	ea. ...	1
*17	4R03726	Clip, lock, chain	ea. ...	1
*17	4R03728	Stylus	ea. ...	1
*17	4R03730	Pulley	ea. ...	2
*15	4R03732	Band, bellows	ea. ...	1
*15	4R03734	Bellows	ea. ...	1
*17	4R03736	Balance, spring, complete, with accessories..	ea. ...	1
*18	4R03738	Clip, chain	ea. ...	1

Fig. No.	Medical Dept. No.	Nomenclature	Unit	Quantity
*17	4R03743	Motor, clock, 110v., 25 cycle, a.c.	ea.	1
	4R03744	Motor, clock, 110v., 60 cycle, a.c.	ea.	1
	4R03745	Motor, clock, 220v., 60 cycle, a.c.	ea.	1
*18	4R03748	Accessories, chart, cylinder	set	1
*14	4R03750	Yoke, oxygen, complete, assembly	ea.	1
*14	4R03756	Gauge, complete, assembly	ea.	1
*14	4R03758	Handwheel, oxygen	ea.	1
*15	4R03760	Disc, sodalime cover	ea.	1
*18	4R03762	Nut, wing	ea.	6
*	4R03764	Gasket, container	ea.	1
*16	4R03766	Container, sodalime, inner, assembly	ea.	1
*18	4R03774	Lamp, pilot, complete, assembly	ea.	1
*18	4R03776	Bulb, pilot	ea.	1
*14	4R03778	Noseclip, complete, assembly	ea.	1
*17	4R03784	Chain, counterbalance, 27 $\frac{7}{8}$ -in.	ea.	1
*	4R03786	Caster	ea.	3
*	4R03788	Rod, hinge, stand, assembly	ea.	1
*	4R03790	Bracket, hinge	ea.	1
*	4R03792	Container, accessory	ea.	1
*14	4R03794	Stopper, rubber, No. 3	ea.	1
*15	4R03798	Barometer	ea.	1
*16	4R03800	Cover, protective	ea.	1
14	4R03802	Mouthpiece	ea.	3
	4R03804	Book, test strip	ea.	1
14	4R03806	Tester, leak	ea.	1
18	4R05460	Anchor, chain	ea.	1
14	4R05462	Support, flexible, breathing tube	ea.	1
14	4R05464	Clamp, breathing tube	ea.	1
14	4R05466	Holder, noseclip	ea.	1
18	4R05468	Washer, clamp	ea.	1
14	4R05470	Holder, mouthpiece	ea.	1
16	4R05472	Cylinder, chart	ea.	1
17	4R05474	Rod, guide, stylus slide	ea.	2
17	4R05476	Collar, locking, split, for counterbalance ...	ea.	1
17	4R05478	Screw, locking, collar	ea.	1
18	4R05480	Jack, pin, complete, with connection	ea.	2
18	4R05482	Strip, terminal	ea.	1
18	4R05484	Grommet, rubber	ea.	1
17	4R05486	Spindle, chart roll	ea.	1
17	4R05488	Housing, spindle, complete, assembly	ea.	1
17	4R05490	Upright, tube	ea.	1
17	4R05492	Spacer, upright	ea.	1
18	4R05494	Bearing, pulley	ea.	2
17	4R05496	Plate, mounting, for motor	ea.	1
15	4R05498	Base, main	ea.	1
15	4R05500	Plate, bottom	ea.	1
16	4R05502	Rest, rubber	ea.	3
	4R05504	Stand	ea.	1
	4R05506	T-Scale, complete	ea.	1
	4R05508	Calculator, complete	ea.	1

* To be requisitioned from Supply Depot. No asterisk indicates that the item is not stocked as a spare part but can be obtained by special requisition.

INDEX

	PARAGRAPH	PAGE
Assembling:		
McKesson	5b	3
Sanborn	15b	10-12
Barometer:		
McKesson	8b	5
Sanborn	18d	14
Breathing Valve, Sanborn	17d	13
Charging:		
McKesson:		
Oxygen	10e	6-7
Soda lime	10b	6
Charts:		
McKesson, Testing	10g	8
Sanborn, Poorly Marked	68	29
Types	3c	1
Circulation, Sanborn, Checking	73	30
Cleaning:		
McKesson	53	25
Sanborn	89	35
Controls:		
McKesson	7a-d	3-5
Sanborn	17	12-13
Counterbalance Tension, Sanborn, Adjustment	77	32
Definition	3	1
Disassembling:		
McKesson	1 (App. I)	45
Sanborn	3 (App. I)	45
Electric power, source	3b	1
Handwheel, Sanborn	17a	12
Inhaler:		
McKesson:		
Adjustment	10i	8
Shut-off Valve	7c	5
Instruments:		
McKesson	8	5
Sanborn	18	13-14

	PARAGRAPH	PAGE
Leaks, Sanborn	74	30-31
Lubrication:		
McKesson	27	20
Sanborn	58	27
Maintenance instructions:		
McKesson	42-56	23-26
Sanborn	73-92	30-37
Maintenance, Preventive:		
McKesson	28-31	20-21
Sanborn	59-64	28
Moat, McKesson	10d	6
Operation:		
McKesson	9-13	5-9
Sanborn	19-25	14-19
Oxygen:		
McKesson, stopcock	7b	5
Sanborn, valve	17b	13
Replacement	92	36-37
Packing, Sanborn	4 (App. I)	46
Paper, McKesson Changing	54	25
Parts:		
McKesson	—	48-49
Sanborn	—	50-51
Pen:		
McKesson, Adjustment	10f	7-8
McKesson, cleaning	46	23-24
Sanborn, capillary	97 (App. II)	47
Penholder Assembly, Sanborn, removal and re- placement	81	34
Precautions, McKesson	13	9
Preparation for Operation:		
McKesson	10	6-8
Sanborn:		
Known amount of oxygen	23	18-19
Unknown amount of oxygen	20	15-17
Pressure Gauge, Sanborn	18b	13
Removal and Replacement of Parts:		
McKesson	47-51	24-25
Sanborn	78-87	34-35
Repacking, McKesson	2 (App. I)	45

	PARAGRAPH	PAGE
Rubber Bellows, Sanborn, removal and replacement	79	34
Soda Lime:		
McKesson, testing	55-56	26
Sanborn, container, removal and replacement	78	32-33
Sterilization:		
McKesson	52	25
Sanborn	88	35
String, McKesson, Replacement	47	24
Stylus Pressure, Sanborn Adjustment	91	36
Testing:		
McKesson, Flutter valve	10c	6
Sanborn, Leaks	20f	17
Sanborn, Soda Lime	75-76	31
Thermometer:		
McKesson	8a	5
Sanborn	18a	13
Thermometer Assembly, Sanborn, Removal and Replacement	80	34
Toggle Switch:		
McKesson	7a	3
Sanborn	17c	13
Trouble Shooting:		
McKesson	32-41	21-23
Sanborn	65-72	28-29
Unpacking:		
McKesson	5a	3
Sanborn	15a	10
Valves, McKesson replacement	48	24
Water Stopcock, McKesson	7d	5

